Spectrum



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Abiotic Stress in Plants

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Abiotic environmental stresses, such as salt, drought and cold greatly affect crop productivity throughout the world. Therefore, development of transgenic crops tolerant to these abiotic stresses is always on the mind of scientists. However, it has been difficult to produce tolerant cultivars either through conventional breeding or by utilizing the modern transgene approach but efforts are currently in-progress worldwide.

Problems caused by abiotic environmental stresses

Abiotic stress represents the most limiting environmental factors affecting agricultural productivity. When crop plants are subjected to face environmental stress conditions, they fail to express their full genetic potential for production. Generally plants respond to these stresses under low and or moderate levels but when the stress level exceeds a certain level, which varies from crop to crop, the physiological mechanism imparting tolerance breakdowns which causes plant death. Consequently the abiotic stress factors cause a massive loss in the productivity of crop plant. According to the ICRISAT report (ICRISAT, 2006) biotic and abiotic stress factors lead to a loss of US $15.74 billion annually. These stresses cause reduced seed germination and seedling establishment, poor seedling vigor, reduced canopy, reduced photosynthetic rates, decrease in root length, leaf rolling, leaf scorching and reduced pollen variability, leaf senescence, incomplete grain filling and ultimately reduction in grain yield at the reproduction stage. Moreover, the sensitivity of different developmental stages to a given stress varies in the life-cycle of a plant species.



A photograph of a tomato transgenic plant with codA gene to impart tolerance to salinity (100mM Nacl) in comparision with wild type (non transgenic) plant of tomato

Conventional breeding methods to combat adverse effect of abiotic stresses

Efforts to sexually breed trait that confer tolerance to these environmental stress have already been made by plant breeders and such efforts are in progress. However the success achieved so far in raising plants tolerant to abiotic stresses by plant breeding methods has not been very impressive. Various reasons can be ascribed for the failures in this regards.

Cellular and plant based response of crop plants to abiotic stress condition is shown to be regulated by a multigene family in most of the cases to be multigenically regulated.

ii) The stress tolerance characteristics are also affected indirectly through epitasis and pleiotropy.

iii) Different abiotic stress interact with each other in field condition in evoking plant response and this situation compounds the overall response of the crop plant to differential level.

Genetic Engineering techniques to combat adverse effects of abiotic stresses

Genetic engineering techniques are being used in tomato variety of crops as improvement programmes to fight the challenges caused by the abiotic stresses. A genetic engineering programme requires the in-vitro regeneration system, an optimal genetic transformation method to deliver the desired gene in to the cell and different factors affecting its transformation, to generate the transgenic plant with desired trait.

Genes involved in abiotic stress tolerance

During last few years research has revealed the molecular basis of abiotic stress resistance. Stress tolerance of plants normally occurs by interaction of a whole network of several different genes. Recent research on transgenic stress tolerant plants has focused on single components of these complex traits even it is a commonly assumed in science that only the introduction of genes from different stress response in to single plant could be an approach for engineering extreme stress tolerance. A key point is the knowledge of regulatory genes that co ordinate the complex gene expression cascade during abiotic stress in the plant.

Under different abiotic conditions a number of genes and gene products impart tolerance when induced in plants. These genes and their products can be classified in two groups. The first group includes proteins that probably have a direct function in stress tolerance and these are called functional proteins. The other set of proteins are involved indirectly and show regulatory functions in signal transduction and gene expression and are called regulatory proteins .

Functional Proteins

The first group includes proteins that probably function in stress tolerance: water channel proteins (aqua porins) involved in the movement of water through membrane, the enzyme required for the biosynthesis of various osmoprotectants(Sugars, pro and glycine betaine etc), proteins that may protect macromolecules and membranes(LEA proteins (late embryogenic abundance), osmotin, antifreeze protein, chaperon and mRNA binding proteins), proteases for protein turn over(thiol proteases, clp proteases and ubiquitin), the detoxification enzymes(glutathione S-transferase,soluble epoxide hydrolase, catalase , superxide dismutase and ascorbate peroxidase). Some of the stress inducible genes that encode protein, such as the key enzyme in pro biosynthesis, were overexpessed in transgenic plants to produce a stress-tolerant phenotype of the plants. This indicates that the gene product really functions in stress tolerance.

Some commonally synthesiszed Osmoprotectants for combating stress condition

Osmoprotectants (compatible solutes) were discovered as one of the most important factors to protect plants against adverse abiotic effects. Osmoprotectants function as osmolytes and protect cells against dehydration by turgor maintenance of roots and shoots in response to water deficit . The active accumulation of compatible solutes during the development of water deficit is termed as osmotic adjustment. Due to the effect of solute concentration by the active accumulation of osmoprotectants in the plant cells, water loss is inhibited. Osmoprotectants reduce adverse effect of water deficit as well as of salinity. According to several studies osmoprotectants such as proline (amino

List of some of the genes involved in imparting stress (abiotic) tolerance

Transgenic crop	Gene introduced	Source of the gene	Performance of transgenic under stress
wheat	HVA1, HKT1	*Barley, wheat*	Drought salanity
Rice	CodA, GS2, adc	*A. globiformis, rice, oat*	Drought , cold and salinity tolerance
mustard	AtNHX1,osmotin	*A. thaliana, tobacco*	Salt and drought
soyabean	Antisense P5CR	*A. thaliana*	Drought tolerance
alfalfa	FeSod, MnSOD	*A. thaliana,tobacco*	Freeze tolerance
cotton	Apx, GR	*Pea, A.thaliana*	Cold tolerance
Potato	ZnSOD, osmotin	*Tomato, potato*	Oxidative and late blight tolerance
tomato	HAL1, CBF1	*Yeast, A.thaliana*	Salt tolerance

acid), glycine betaine and sugars (mannitol, fructans, and trehalose) help plants to overcome water deficit stress.

Glycine betaine

One of the most effective osmoprotectant is glycine betaine. This substance occurs naturally in some crops like sugarbeet and cotton and in many highly salt and drought tolerant wild plants. Choline oxidase(COD), which is isolated from Arthrobacter globiformis or choline dehydrogenase (CHD) and choline monooxygenase (CMO) in the plants are the enzymes involved in glycine betaine synthesis. Transgenic tobacco and Arabidopsis plants producing COD, CDH, and CMO have shown enhanced tolerance against various abiotic stresses. It has also been reported that the availability of choline is the limiting factor in glycine betaine production in transgenic plants .The problem can be overcome to some extent by exogenous choline supply, however. Glycine betaine has also been shown to protect enzymes and membranes from cold, heat, salt and freezing stress. Many stress susceptible crops including most fruits and vegetable do not contain suitable amounts of glycine betaine and other osmoprotectants. It has been shown that introduction of glycine betaine in different crop plants leads to salt and drought.

Mannitol

The sugar alcohol mannitol seems to play an important role in osmotic adjustment and provides enhanced tolerance in response to high salinity and water stress . It has been shown that mannitol overproduction through E-coli mannitol 1-phosphate dehydrogenase (Mt1D) gene expression in transgenic tobacco provides enhanced tolerance against salinity stress .Over accumulation of D mannitol up to a remarkable limit of 600 mM in cytosol provided osmotic tolerance to transgenic tobacco.

Trehalose

At the plant cellular level, the disaccharide trehalose helps maintain individual cell structure and function during severe environmental stress conditions. Trehalose can act as a water substitute on the surface of macromolecules. Protein and other macromolecules are thereby protected against desiccation. Thus the structure and biological activity is maintained. These protective properties of trehalose help plants to survive under different abiotic stress conditions. Engineering of trehalose metabolism by transferring trehalose- 6- phosphate synthase (TPS1) gene in tobacco plant showed improved drought tolerance. It has also been shown that trehalose accumulation in rice plant confers high tolerance to different abiotic stresses.

Proline

Proline is an important osmolyte. Over expression of this in transgenic tobacco showed enhanced biomass production, better plant growth and flower development under drought and salinity stress. It has been reported that accumulation of free proline in transgenic tobacco plants overexpressing osmotin gene imparts tolerance to drought and salinity. It has also been shown under stress conditions that prohydrogenase showed no signs of osmotolerance but exogenous addition of proline increased survival rate of salt stressed plant by 30%. Over expression of ornithine-δ-aminotransferase increases proline biosynthesis and confers osmotolerance in transgenic plants.

Fructans

Fructans are polyfructose molecules produced by many plants and bacteria. Great number of plant species use fructans as their storage carbohydrate. In contrast to starch fructans are soluble in water. For this reason it was assumed that fructans may play a role in osmotic adjustment. It has been reported that fructans synthase (Sac B) gene is responsible for fructans biosynthesis, showed tolerance to freezing and Poly ethylene glycol mediated water stressing transgenic tobacco.

The second group contains protein factors involved in further regulation of signal transduction and gene expression that probably function in stress response protein kinases, transcription factors, secondary signalling molecules. Through their regulatory pathways it is important to understand plant responses to abiotic stress.

Future prospects

Salt and drought tolerance is one of the number of traits that can have a major impact in both the developed and developing countries by allowing crops to be grown where they normally can not, with less water or with poor quality of water. Until recently salt and drought stress signaling is a mystery. Although, exciting progresses have been made by finding molecular identities of some of the signaling elements, still we do not have a clear picture. Therefore, it is a challenge to have complete understanding of the signal transduction pathways for salt and drought stress.

Genetic approaches are important tools for analyzing complex processes like signal transduction. Convention genetic screening process based on stress injury are tolerance phenotypes have been applied with success. However, such screens may not be able to identify all components in signaling cascades due to functional redundancy of pathway in the control of plant stress tolerance. Accessibility of various reverse genetic strategies such as RNAi-, T-DNA- and transposon-mediated strategies for genetic knockout mutants should lead to the identification of many more signaling components to have a clear picture of abiotic stress signaling networks. The most prominent missing element in signal transduction of various abiotic stresses is the sensors or receptors.

In this age of genomics and proteomics when Arabidopsis genome and draft of the rice genomhas been completed, there is much to be learned about the function of specific genes and patterns of gene expressions. The sequenced genome holds the key to our missing knowledge about the mechanism of absisic acid action in the plant growing under water deficit conditions. In order to adopt efficient transgenic strategy for improving salt and drought stress, we should know the proportion of drought tolerance implicated by each and every gene of the thousands of genes up regulated during abiotic stress tolerance. This will help in identifying the major genes playing role in the stress tolerance for their use in genetic engineering and transgenic programs.

Genetically engineered plants that are transgenic for salt and/or drought tolerance may face the same consumer backlash that other GM plants are facing. But GM proponents feel that with time and improved communications, current opponents will find that the benefits outweigh the risks. The resistance to GM crops, if any, is acceptable for certain cases only. GM crops hold unbelievable promise, of course with some risks; there must be more open discussion about the risks of the technology, as well as the risks of not using the technology.

"Education is the great engine of personal development. It is through education that the daughter of a peasant can become a doctor, that the son of a mineworker can become the head of the mine, that a child of farm workers can become the president of a great nation. It is what we make out of what we have, not what we are given, that separates one person from another."

Nelson Mandela

First Democratically Elected President of South Africa

Biotechnology Down the years: Historical Events

Dr. P.K. Shukla and Dr. Pragati Misra
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BC

1750 The Sumerians brewed beer.

500 The Chinese used moldy soybean curds as an antibiotic to treat boils.

250 The Greeks practiced crop rotation to maximize soil fertility.

100 Powdered chrysanthemum was used in China as an insecticide.

AD: BEFORE THE 20TH CENTURY

1590 The microscope was invented by Janssen.

1663 Cells were first described by Hooke.

1675 Leeuwenhoek discovered protozoa and bacteria.

1797 Jenner inoculated a child with a viral vaccine to protect him from smallpox.

1802 The word "biology" first appeared.

1824 Dutrochet discovered that tissue was composed of living cells.

1830 Proteins were discovered.

1833 The cell nucleus was discovered.

The first enzyme was isolated.

1855 The Escherichia coli bacterium was discovered and later became a major research, development, and production tool for biotechnology.

Pasteur began working with yeast, eventually proving they were living organisms.

1863 Mendel, in his study of peas, discovered that traits were transmitted from parents to progeny by discrete, independent units, later called genes. His observations laid the groundwork for the field of genetics.

1869 Miescher discovered DNA in the sperm of trout.

1877 A technique for staining and identifying bacteria was developed by Koch.

1878 The first centrifuge was developed by Laval.

The term "microbe" was first used.

1879 Flemming discovered chromatin, the rod-like structures inside the cell nucleus that later came to be called "chromosomes."

1883 The first rabies vaccine was developed.

1888 The chromosome was discovered by Waldyer.

AD: FIRST HALF OF THE 20TH CENTURY

1902 The term "immunology" first appeared.

1906 The term "genetics" was introduced.

1907 The first in vivo culture of animal cells was reported.

1909 Genes were linked with hereditary disorders.

1911 The first cancer-causing virus was discovered by Rous.

1914 Bacteria were used to treat sewage for the first time in Manchester, England.

1915 Phages, or bacterial viruses, were discovered.

1919 The word "biotechnology" was first used by a Hungarian agricultural engineer.

1920 The human growth hormone was discovered by Evans and Long.

1927 Muller discovered that X-rays cause mutation.

1928 Fleming discovered penicillin, the first antibiotic.

1938 The term "molecular biology" was coined.

1941 The term "genetic engineering" was first used by a Danish microbiologist.

1942 The electron microscope was used to identify and characterize a bacteriophage- a virus that infects bacteria.

1943 Avery demonstrated that DNA is the "transforming factor" and the material of genes.

1944 DNA was shown to be the material substance of the gene.

1949 Pauling showed that sickle cell anemia as a "molecular disease" resulting from a mutation.

1950 TO 1960

1951 McClintock discovered transposable elements, or "jumping genes," in corn.

1953 Watson and Crick revealed the three-dimensional structure of DNA.

1954 Cell-culturing techniques were developed.

1955 An enzyme involved in the synthesis of a nucleic acid was isolated for the first time.

1956 The fermentation process was perfected in Japan.

Kornberg discovered the enzyme DNA polymerase I, leading to an understanding of how DNA was replicated.

1957 Sickle cell anemia was shown to occur due to a change of a single amino acid.

1960 Exploiting base pairing, hybrid DNA-RNA molecules were created.

Messenger RNA was discovered.

1961 The genetic code was understood for the first time.

1964 The existence of reverse transcriptase (RT) was predicted.

1967 The first automatic protein sequencer was perfected.

1969 An enzyme was synthesized in vitro for the first time.

1970S

1970 Specific restriction nucleases were identified, opening the way for gene cloning.

RT was discovered independently in murine and avian retroviruses.

1971 RT was shown to have ribonuclease H (Rnase H) activity.

1972 The DNA composition of humans was discovered to be 99% similar to that of chimpanzees and gorillas.

Purified RT was first used to synthesize cDNA from purified mRNA in vitro.

1973 Cohen and Boyer perform the first successful recombinant DNA experiment, using bacterial genes.

1974 The National Institute of Health formed a Recombinant DNA Advisory Committee to oversee recombinant genetic research.

1975 Colony hybridization and Southern blotting were developed for detecting specific DNA sequences.

The first monoclonal antibodies were produced.

1976 The tools of recombinant DNA were first applied to a human inherited disorder.

Molecular hybridization was used for the prenatal diagnosis of alpha thalassemia.

Yeast genes were expressed in E. coli bacteria.

1977 Genetically engineered bacteria were used to synthesize human growth protein.

1978 North Carolina scientists Hutchinson and Edgell show it was possible to introduce specific mutations at specific sites in a DNA molecule.

1979 The first monoclonal antibodies were produced.

1980S

1980 The U.S. Supreme Court, in the landmark case Diamond v. Chakrabarty, approved the principle of patenting genetically engineered life forms.

The U.S. patent for gene cloning was awarded to Cohen and Boyer.

1981 The North Carolina Biotechnology Center was created by the state's General Assembly as the nation'ed first state-sponsored initiative to develop biotechnology. Thirty-five other states follow with biotechnology centers of various kinds.

The first gene-synthesizing machines were developed.

The first genetically engineered plant was reported.

Mice were successfully cloned.

1982 Humulin, Genentech's human insulin drug produced by genetically engineered bacteria for the treatment of diabetes, was the first biotech drug to be approved by the Food and Drug Administration.

1983 The Polymerase Chain Reaction (PCR) technique was conceived. PCR, which uses heat and enzymes to make unlimited copies of genes and gene fragments, later becomes a major tool in biotech research and product development worldwide.

The first genetic transformation of plant cells by TI plasmids was performed.

The first artificial chromosome was synthesized.

The first genetic markers for specific inherited diseases were found.

Efficient methods were developed to synthesize double-stranded DNA from first-strand cDNA involving minimal loss of sequence information.

1984 The DNA fingerprinting technique was developed.

The first genetically engineered vaccine was developed.

Chiron clones and sequenced the entire genome of the HIV virus.

1985 Fully active murine RT was cloned and overexpressed in E. coli.

1986 The first field tests of genetically engineered plants (tobacco) were conducted.

Ortho Biotech's Orthoclone OKT3, used to fight kidney transplant rejection, was approved as the first monoclonal antibody treatment.

The first biotech-derived interferon drugs for the treatment of cancer, Biogen's Intron A and Genentech's Roferon A, were approved by the FDA. In 1988, the drugs were used to treat

Kaposi's sarcoma, a complication of AIDS.
The first genetically engineered human vaccine, Chiron's Recombivax HB, was approved for the prevention of hepatitis B.
1987 Humatrope was developed for treating human growth hormone deficiency.
Advanced Genetic Sciences' Frostban, a genetically altered bacterium that inhibits frost formation on crop plants, was field tested on strawberry and potato plants in California, the first authorized outdoor tests of an engineered bacterium.
Genentech's tissue plasminogen activator (tPA), sold as Activase, was approved as a treatment for heart attacks.
Reverse transcription and PCR were combined to amplify mRNA sequences.
Cloned murine RT was engineered to maintain polymerase and eliminate Rnase H activity.
1988 Congress funded the Human Genome Project, a massive effort to map and sequence the human genetic code as well as the genomes of other species.
1989 Amgen's Epogen was approved for the treatment of renal disease anemia.
Microorganisms were used to clean up the Exxon Valdez oil spill.
The gene responsible for cystic fibrosis was discovered.

1990S
1990 The first federally approved gene therapy treatment was performed successfully on a 4-yearold girl suffering from an immune disorder.
1991 Amgen developed Neupogen, the first of a new class of drugs called colony stimulating factors, for the treatment of low white blood cells in chemotherapy patients.
Immunex's Leukine, used to replenish white blood counts after bone marrow transplants, was approved.
Genzyme's Ceredase was approved for the treatment of Gaucher's disease.
1992 The three-dimensional structure of HIV RT was elucidated.

Recombinate, developed by Genetics Institute and used in the treatment of hemophilia A, became the first genetically engineered blood clotting factor approved in the U.S. Chiron's Proleukin was approved for the treatment of renal cell cancer.
1993 Chiron's Betaseron was approved as the first treatment for multiple sclerosis in 20 years.
The FDA declared that genetically engineered foods were "not inherently dangerous" and do not require special regulation.
The Biotechnology Industry Organization (BIO) was created by merging two smaller trade associations.
1994 Genentech's Nutropin was approved for the treatment of growth hormone deficiency.
The first breast cancer gene was discovered.
Calgene's Flavr Savr tomato, engineered to resist rotting, was approved for sale.
1995 The first baboon-to-human bone marrow transplant was performed on an AIDS patient.
The first full gene sequence of a living organism other than a virus was completed for the bacterium Hemophilus influenzae.
The three-dimensional structure of a catalytically active fragment of murine RT was elucidated.
1996 Biogen's Avonex was approved for the treatment of multiple sclerosis. The company builded a $50 million plant in Research Triangle Park, N.C., to manufacture the recombinant interferon drug.
Scottish scientists cloned identical lambs from early embryonic sheep.
1997 Scottish scientists reported cloning a sheep, using DNA from adult sheep cells.
A group of Oregon researchers claimed to have cloned two Rhesus monkeys.
A new DNA technique combines PCR, DNA chips, and a computer program, providing a new tool in the search for disease-causing genes.
1998 University of Hawaii scientists cloned three generations of mice from nuclei of adult ovarian cumulus cells.

Human skin was produced in vitro.
Embryonic stem cells were used to regenerate tissue and create disorders mimicking diseases.
The first complete animal genome for the elegans worm was sequenced.

A rough draft of the human genome map was produced, showing the locations of more than 30,000 genes.

Cloned vain RT with fully active polymerase and minimized Rnase H activity was engineered.

The Biotechnology Institute was founded by BIO as an independent national, 501(c)(3) education organization with an independent Board of Trustees.
1999 The complete genetic code of the human chromosome was first deciphered.

The rising tide of public opinion in Europe brings biotech food into the spotlight.

2000 AND BEYOND
2000 A rough draft of the human genome was completed by Celera Genomics and the Human Genome Project.

Pigs were the next animal cloned by researchers, hopefully to help produce organs for human transplant.
"Golden Rice," modified to make vitamin A, promised to help third-world countries alleviate blindness.

The 2.18 million base pairs of the commonest cause of bacterial meningitis, Neisseria meningitidis, were identified.

2001 The sequence of the human genome was published in Science and Nature, making it possible for researchers all over the world to begin developing treatments.

2002 Scientists completed the draft sequence of the most important pathogen of rice, a fungus that destroys enough rice to feed 60 million people annually. By combining an understanding of the genomes of the fungus and rice, scientists will elucidate the molecular basis of the interactions between the plant and pathogen.
2003 Dolly, the cloned sheep that made headlines in 1997, was euthanized after developing progressive lung disease. Dolly was the first successful clone of a mammal.

(1) As per your topic no. future perspective is find in your article either add some future perspetive or change title.
(2) Add some good quality images in your article to make it more attractive.

"Schools must enquire deeper into their own practices, explore new ways to motivate their learners, make use of learning styles, introduce multiple intelligences, integrate learning, and teach thinking, and in the process discover the passion and moral purpose that makes teaching exciting and effective. It is what teachers think, what teachers do, and what teachers are at the level of the classroom that ultimately shapes the kind of learning that young people get."

Michael Fullan,
Dean of Ontario Institute for Studies in Education and Teacher Development and Andy Hargreaves, Chair in Education, Boston College

Blue Gene: A vision for protein science using a petaflop supercomputer

Mr. Manish Rajpal, Priyanka Srivastava and Kinshuki Sharma
Lecturer, Department of Biotechnology, IAMR, Ghaziabad

In the December 1999, IBM announced the start of a five-year effort to build a massively parallel computer called Blue Gene to be applied to the study of biomolecular phenomena such as protein folding. The project has two main goals:

(i) to advance our understanding of the mechanisms behind protein folding via large-scale simulation, and
(ii) to explore novel ideas in massively parallel machine architecture and software.

The Blue Gene project should enable biomolecular simulations that are orders of magnitude larger than current technology permits. Major areas of investigation include: how to most effectively utilize this novel platform to meet our scientific goals, how to make such massively parallel machines more usable, and how to achieve performance targets, with reasonable cost, through novel machine

Motivation for IBM

The mission of the Blue Gene:supercomputer scientific program is to use large-scale biomolecular simulation to advance our understanding of biologically important processes, in particular our understanding of the mechanisms behind protein folding.The scientific knowledge derived from research on protein folding can potentially be applied to a variety of life sciences related problems of great scientific and commercial interest, including:

- Protein-drug interactions (docking)
- Enzyme catalysis (through use of hybrid quantum and classical methods)[4]
- Refinement of protein structures created through other methods

Protein science overview

The human genome is currently thought to contain approximately 20,000 genes, which code for a much larger number of proteins through alternative splicing and post-translational modifications,proteins are assembled to handle a huge diversity of functions. An understanding of how proteins function is essential for understanding the cell life cycle and metabolism, how cells send signals to their environment, and how cells receive and process signals from their environment. An understanding of protein structure and function can serve as a basis for innovation in new therapies, diagnostic devices, and even industrial applications. The function of proteins is intimately associated with their structure.[1] The examples shown in Figure 1 illustrate this. When proteins fold into the wrong structure, the results can be fatal, e.g., “mad cow” disease probably results from an autocatalyzed wrong fold in the prion protein and cystic fibrosis is also connected with protein (mis) folding.

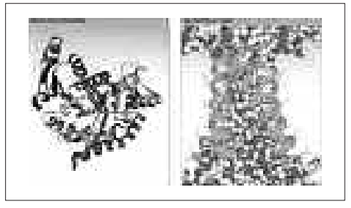


Figure -1: 3D Protein Structure

Protein architecture. Protein architecture is based on three principles:

1. The formation of a polymer chain
2. The folding of this chain into a compact function-enabling structure, or native structure
3. Post-translational modification of the folded structure

The protein chain (or peptide chain if short in length) is a heteropolymer built up from alpha amino acid monomers, as shown in Figure 2. The sequence of amino acid residues in the peptide chain is termed the primary structure of the protein. The 20 different choices for each amino acid in the chain give the possibility of enormous diversity, even for small proteins. For example, a peptide of 30 residues yields the astonishing number of about 2030, or approximately 1039, possible unique sequences.

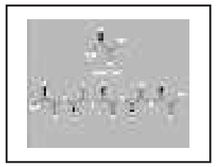


Figure -2: Different R - Groups in Amino Acids

From the enormous number of possible protein sequences that could exist, relatively few in nature exists. It is thought that the diversity of viable proteins has been constrained by natural selection to give:

1. Desired function
2. Adequate stability
3. Foldability
4. Evolvability from appropriate evolutionary precursors

The peptide chain has certain local fold characteristics termed secondary structure. Steric hindrance and energetic considerations favour certain conformations of the peptide chain. One such conformation is the alpha helix (see red helices in Figure 3). Another secondary structure is the beta sheet (blue flattened regions in Figure 3), in which two or more strands of the peptide chain are aligned to form a sheet. The relatively organized alpha helix and beta sheet sections of a protein are joined by less organized loop or turn regions. The way in which the relatively localized secondary structure elements combine to form the overall compact protein is termed the tertiary level of structure. Finally, quaternary structure refers to the way that tertiary structures from two or more chains combine to form much larger structures.

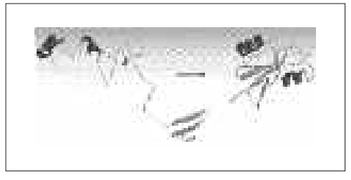


Figure -3: Steps in protein folding

Why protein folding mechanisms are important. The fact that a subset of heteropolymers constructed from amino acids and are used in biological processes actually take on reproducible three-dimensional structures in a relatively short time of seconds or less is one of the marvels of nature. Heteropolymers typically form a random coil in solution and do not “fold” to any reproducible structure in experimentally accessible times. Consider the paradox noted by Levinthal, which asks the reader to consider that if, say, we allow three possible conformations for every amino acid residue on the peptide chain, a 100-residue protein would have ($3^{100} = 10^{47}$) configurations. Any unbiased exploration of this conformational space would take a vast amount of time to complete. Thus, the proteins that fold reproducibly and quickly into particular shapes must have been selected in some way for these properties. It is hypothesized that these proteins conduct this conformational search along particular pathways that allow the folding process to proceed quickly. One of the challenges in the study of protein dynamics is to understand the mechanisms behind this behavior. An improved understanding of these mechanisms is not only interesting from a purely scientific perspective, but might eventually allows us to engineer other “self-assembling” structures.

Current view of folding mechanisms. A simplistic but illustrative way of viewing protein folding is to note that the amino acid R groups (see Figure 2,) fall into three main classes: (1) charged, (2) hydrophilic (“water-loving”), and (3) hydrophobic (“water-hating”). In the simplest picture, the folded state of the peptide chain is stabilized primarily (for a globular protein in water), by the burying of the hydrophobic groups into the core of the protein—out of contact with water, while the hydrophilic and charged groups remain in contact with water. The stability can be described in terms of the Gibbs free-energy change

$$\triangle G = \triangle H - T \triangle S$$

where H is the enthalpy change and S is the entropy change. H is negative due to the more favorable hydrophobic interactions in the folded state, but so is S because the folded state is much more ordered and has lower entropy than the unfolded state. The balance between the enthalpy and entropy terms is a delicate one, and the total free-energy change is only of order 15 kilocalories per mole. Evidently the internal hydrophobic/external hydrophilic packing requirement places strong constraints on the amino acid sequence, as does the requirement that the native state be kinetically accessible. It is helpful to think of the physics of the folding process as a “free-

energy funnel, shown in Figure 4. Since the folding process is slow relative to motions at atomic scale, The free energy surface may be displayed as a function of some reduced dimensionality representation of the system configuration in a given state of the protein. Figure 4 is a vertical plot of free energy in a contracted two-dimensional space (horizontal plane) representing the configuration of the peptide chain. The most unfolded configurations are the most numerous, but have the highest free energy, and occur on the rim of the funnel. Going into the funnel represents a loss of number of configurations (decrease of entropy), but a gradual decrease in free energy, until the native state with very few configurations and the lowest free energy is reached at the bottom of the funnel. The walls of the funnel contain only relatively shallow subsidiary minima, which can trap the folding protein in non-native states, but only for a short time. Now the evolution of the system as it folds can be described in terms of the funnel. The system starts off in a physically probable state on the rim of the funnel, and then makes transitions to a series of physically accessible states within the funnel, until the bottom of the funnel is gradually approached. The folding process in different proteins spans an enormous dynamic range from approximately 20 microseconds to approximately 1 second.



Figure-4: Protein Folding Energy Funnel

Probes of folding. In biophysical studies of protein folding, current emphasis is on the reversible folding of moderate-sized globular proteins under closely controlled conditions in vitro. Many globular proteins can be made to unfold in vitro and then to undergo a refold back to the native structure without any external assistance. The unfolding process can be driven in several ways, for example by changes in denaturant concentration, by heat pulses, by pressure pulses, etc. In this manner, refolding times down to tens of microseconds can be measured.Although the study of protein dynamics and folding pathways via experiment is an active area of research and much progress is being made, experimental probes do not yet provide as complete a view of protein dynamics at the microscopic length and time- scales as one would like. Numerical simulations offer a potential window into this microscopic world. The simplest systems for study are those with less than approximately 120 residues, which constitute "two-state folders," i.e., there is no intermediate between the denatured and native states. Such ideal systems should also not contain prosthetic groups, i.e., they should be pure peptides, should not require the assistance of "chaperones" to fold, and should preferably not have disulfide bonds.

Consider the following three types of protein science studies that might employ large-scale numerical simulation techniques:

- Structure prediction
- Folding pathway characterization
- Folding kinetics

Protein structure prediction can be carried out using a large number of techniques and, as previously discussed, it is unnecessary to spend a "petaflop year" on the prediction of a single protein structure. That said, there is some reason to believe that atomistic simulation techniques may be useful in refining structures obtained by other methods.

Folding pathway characterization typically involves the study of thermodynamic properties of a protein in quasi-equilibrium during the folding process. Mapping out the free-energy "landscape" that the protein traverses as it samples conformations during the folding process can give insights into the nature of intermediate states along the folding pathway and into the "ruggedness" of the free-energy surface that is traversed during this process.

Simulation studies of folding kinetics are aimed at understanding the rates at which the protein makes transitions between various conformations.

Both pathway and kinetic studies may "zoom in" on selected regions of interest in the folding process rather than trying to simulate the process from end to end.

Challenges for computational modeling. The current expectation is that it will be sufficient to use classical techniques, such as molecular dynamics (MD), to model proteins in the Blue Gene project. This is because many aspects of the protein folding process do not involve the making and breaking of covalent bonds. While disulfide bonds play a role in many protein structures, their formation will not be addressed by classical atomistic simulations. In classical atomistic approaches, a model for the interatomic interactions is used. This is known as a potential, or force field, since the forces on all the particles can be computed from it, if one has its mathematical expression and all its parameters. The MD approach is to compute all the forces on all the atoms of the computer model of the protein and solvent, then use that force to compute the new positions of all the atoms a very short time later. By doing this repeatedly, a trajectory of the atoms of the system can be traced out, producing atomic coordinates as a function of time.Newton's equation is integrated for each particle using a small time step of the order of 10–15 seconds. This small time-step size is required to accurately describe the fastest vibrations of the protein and solvent system, which tend to be those associated with movement of hydrogen atoms in the protein and water. The magnitude of the computational cost can be seen when one notes that folding times of approximately 10–4 seconds are observed in some fast-folding systems, requiring the computation of approximately 1011 MD time steps. As can be seen in Table 1, the computational requirements for studying protein folding are enormous.

Table 1 The computational effort required to study protein folding is enormous. Using crude workload estimates for a petaflop/second capacity machine leads to an estimate of three years to simulate 100 microseconds.

Physical time for simulation	10–4 seconds
Typical time-step size	10–15 seconds
Number of MD time steps	1011
Atoms in a typical protein and water simulation	32000
Approximate number of interactions in force calculation	109
Machine instructions per force calculation	1000
Total number of machine instructions	1023

Simulation options.. For physically meaningful studies of protein folding, it will be necessary to simulate a large number of trajectories in order to reach conclusions supported by reasonable statistics. Estimates of the number of trajectories required, for each system studied, range from 10 to 100 in order, for example, to derive a crude estimate of the characteristic time for a step in a folding process. This requirement places limitations on the sizes of systems and the lengths of individual dynamical simulations that can be undertaken. There is some evidence that multiple simulations of limited duration provide more information than a single longer trajectory representing an equivalent amount of computation. For force-field characterizations, too, many simulations will be required on a large variety of protein and peptide systems using different force fields.The simulation of a large variety of protein and smaller peptide systems in the Blue Gene program for various amounts of time and, for many, with a high degree of replication in order to obtain meaningful statistics

Hardware

A petaflop/s power (1015 floating-point operations per second) computer, with something like 50 times the computing power of all supercomputers in the world today, can only be realized through massive parallelism.. A conventional implementation of a petaflop/s machine would be too massive, expensive, and unreliable. Because of the communications requirement, solutions involving huge numbers of loosely coupled personal computers are too inefficient for the desired applications.

Summary

The Blue Gene project represents a unique opportunity to explore novel research into a number of areas, including machine architecture, programming models, algorithmic techniques, and biomolecular simulation science. As discussed, every aspect of this highly adventurous project involves significant challenges. Carrying out planned program will require a collaborative effort across many disciplines and the involvement of the worldwide scientific and technical community. In particular, the scientific program will engage with the life sciences community in order to make best use of this unique computational resource.

Biosurfactant: An ecofriendly and economic solution to pollution

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It is a new world of possibilities in which a spark of imagination one day can become the life saving reality of the next. Microbial surface-active agents (biosurfactants) have been recognized as important microbial products with properties applicable in a number of industries and processes. A biosurfactant can be defined as a surface active molecule produced by living cells in a majority of cases by microorganisms. Like a molecule of surfactants, the molecular structure of bio surfactant consists of both hydrophilic and hydrophobic domains with in the same molecule. Biosurfactants are biodegradable surfactants produced by micro-organisms or enzymes produced by them. Surfactants produced from chemical based materials are known as synthetic surfactants and from biological based materials as biosurfactants. It has both hydrophobic and hydrophilic group. Biosurfactants are today thought to be the efficient replacements of chemically synthesized surface-active agents. Biosurfactant production from micro-organisms has been studied extensively from more than a decade. In recent years, much interest and attention have been directed towards an important molecule, biosurfactants, due to their broad range functional properties and the diverse synthetic capabilities of microbes. Microbial surface-active agents that is, biosurfactants are today thought to be efficient surfactant are high molecular weight lipid complexes, which are normally produced under aerobic conditions and can be classified as Glycolipids, hydro xylated and cross linked fatty acids, polysaccharides- lipid complexes, lipoprotein-lipopeptides and phospholipids. After the production, biosurfactants can be purified by various procedures such as ammonium sulphate fractionation, chilled acetone and hexane treatment, silica gel column chromatography and sephadex LH-20 gel filtration, The purified biosurfactants are highly stable over a broad range of pH (2-12) and temperatures (100 C, 3hr). Biosurfactants play very important role in bioremediation, exhibit high surface activity, emulsifying activity and they are readily biodegradable having lower toxicity. These are a unique class of amphipathic molecules having metal-contaminated sites in the enhanced transport of bacteria, in oil recovery, as cosmetic additives and in biological control and have antibiotic activity. They have ability to change surface-active phenomena such as a lowering of surface and interfacial tensions, wetting and penetrating actions, spreading, hydrophilicity and hydrophobicity, and emulsification and deemulsification, detergency, gelling, foaming, flocculating actions, microbial growth enhancement, metal sequestration and antimicrobial action.

Bio surfactants in petroleum related activity and industries are important as they offer attractive alternative products in use of emulsification, de-emulsification, solubilization, foaming, enhanced oil recovery, in cleaning oil spill, etc. :Much more advantages of biosurfactants are application in the food industry, pharmaceutical, and cosmetics and in specialty chemical industries The striking advantages of bio surfactant over the chemical surfactants are they have a broad range of novel structural characteristics and physical properties, these compounds can be produced by relatively simpler and inexpel1sive procedure using renewal substrates, their structure and function can be modified by genetic engineering, biological or biochemical techniques and they are eco-friendly due to complete biodegradability. In recent years, the interest in using bio surfactant has been steadily increased due to their better environmental compatibility. Commercially available synthetic surfactants are toxic and either slow or non-biodegradable and persists in the environment for longer periods causing harm to ecosystem. The effect of synthetic surfactants generally influences the permeability of biological membrane and anti-bacterial activities by affecting the release of intra cellular material or by inhibiting respiration. These limitations have been encountered with the use of synthetic surfactants which have persuaded the researchers to search a cost- effective production of bio surfactant using biotechnological approaches. The common lipophillic moiety is the hydrocarbon chain of a fatty acid; the polar or hydrophilic group is derived from ester or alcohol functional groups of neutral lipids, the carboxylate group of fatty acid or amino acids, phosphate containing portions of phospholipids and the carbohydrates of glycolipids. When the surfactants are extracellular, they cause the emulsification of the hydrocarbon. When they are cell wall associated, they facilitate the penetration of hydrocarbon to the periplasmic space. In this sense glycolipids like trehalose and rhamnose lipids appear to play an role in the uptake of water insoluble substrate. Bio surfactants or surface-active compounds are heterogeneous group of surface active molecules produced by micro organisms, which either adhere to cell surface or are excreted extracellulary in the growth medium. These molecules reduce surface tension and Critical Micelle Dilution (CMD) in both aqueous solutions and hydrocarbon mixtures. These properties create micro-emulsion in which micelle formations occur where hydrocarbons can solubilize in water or water in hydrocarbons. Several types of biosurfactant have been isolated and characterized, including. glycolipids, phospholipids, lipopeptides, natural lipids, fatty acids, lipopolysacharides etc. The majority of known biosurfactants are synthesized by water immiscible hydrocarbons but some have been produced on such water- soluble substrates as glucose, glycerol and ethanol. Chemically-synthesized surfactants have been used in the oil industry to aid clean up of oil spills, as well as to enhance oil recovery from oil reservoirs. These compounds are not biodegradable and can be toxic to environment. Biosurfactant have special advantage over their commercially manufactured counterparts because of their lower toxicity, biodegradable nature, effectiveness at extreme temperature, pH, salinity and ease of synthesis. They are potential candidate for much commercial application in the pharmaceutical and food processing and oil recovery industries. Hydrocarbons are commonly used as the substrate for the production of biosurfactants. It has been postulated that the biological function of surface-active compounds is related to hydrocarbon uptake, and therefore a spontaneous release occurs with these substrates. Carbohydrates were rarely used as carbon and energy source for biosurfactant production with the exceptions of *Arthrobacter sp., Bacillus subtilis, Torulopsis bombicola, and Pseudomonas aeruginosa.* although less qualified for spontaneous formation, the production of biosurfactants from carbohydrate substrates offers some advantages as compared with hydrocarbons. From an engineering point of view, hydrocarbon substrates require more sophisticated equipment and more power input to achieve an adequate dispersion of the insoluble hydrocarbons. In addition, the availability of hydrocarbons is limited if applications of biosurfactants other than in enhanced oil recovery are envisaged. Productions of surface-active compounds have been already reported from *P. aeruginosa.* some where studies, the minimal surface tension of the cell –free culture broth was about was about 40 mN m-I. The surface activitv was alwavs related to a glycolipid moiety ,ie a rhamnolipid Two kind of rhamnolipids were formed by *P. aeruginosa.* One, called R-I, consisted of two molecules of rhamnose and two molecules of P-hydroxydecanoic acid. Later, a second kind rhmnolipid, R-2, was also identified. It was similar to R-I, but the molecule contained only one rhamnose unit. It was demonstrated that both R-I and R-2 are essential for *P. aeruginosa* growth on hydrocarbons. The rhamnolipids were produced when hydrocarbons, glycerol, glucose, or peptone were used as the substrate. The best production of bio surfactant was obtained with hydrocarbons or glycerol. For the bulk production of bio surfactants, a primary prerequisite is the optimization of culture conditions in which high yields of surface-active compounds are obtained by a particular micro organism. This forms the basis for a realistic estimation of the feasibility of bio surfactant production.

Software Testing: A key issue for quality assurance

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The role of Computer applications is virtually inescapable in the modern world. The key factor, which is embedded in all computer applications, is the "Software" that works inside the computer to run those applications. Computer software is the driving force; it is the engine that drives business decision-making. It serves as the basis for modern scientific investigation and problem solving. Software delivers – Information, which is believed as the most important product of the twentieth first century. Software provides a gateway to the worldwide information networks (e.g. the Internet) and it provides the means for acquiring information in all of its forms. Software is embedded in systems of all kinds: medical, telecommunications, military, entertainment, etc. Figure1 shows some of the software applications.

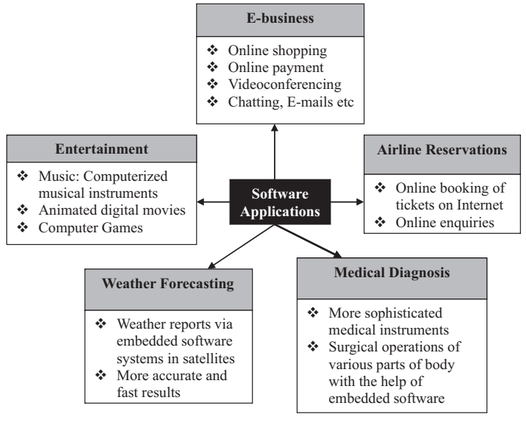


Fig. 1 Applications of Software

Software Development

Software development has become the most important part of the computer industry. The significance of software development cannot be overlooked in the present era of computer applications. To obtain a reliable and efficient software up to the customer's satisfaction and need, it is necessary for the development of any software to follow a definite process, which satisfies a well-defined protocol. Any software development follows a life cycle, which provides a systematic approach to the growth of the software. Fig. 2 illustrates the Linear Sequential Model referred to as "waterfall model" or "classic life cycle" for the software development process. It provides a methodical and sequential approach to software development, which begins, from the system level and progresses through analysis, design, coding, testing and maintenance.

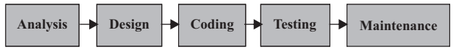


Fig. 2: Linear Sequential Model

The linear sequential model encompasses the following activities/phases:

- **Software requirements analysis:** This phase involves the understanding, study and analysis of the requirements of the software to be developed. All the requisites of the system are deeply analyzed and explored to develop an apt insight of the problem.
- **Design:** The design phase translates the requirement into a representation of the software, which provides basic interfaces, procedures, data structures and algorithms, required just before the actual coding of the software.
- **Coding:** The code of the software (referred to as "programs") has to be generated in a particular computer language so as to make it understandable by computer. This task is accomplished in this phase.
- **Testing:** After the generation of the code, the testing of the software begins to make sure that the functioning of the software is as per the customer's need. Testing is done to rectify the errors introduced in the software in the coding phase or to find out any missing utility in the software.
- **Maintenance:** When the software is delivered to the customer, it is run under the actual working environment. At this stage, many new errors might be identified or many changes could be required to make the software work accurately in the new operating system or peripheral devices. This is carried out in the maintenance phase where the developers provide the needful to the customer.

Testing - Need and Importance

Since software is developed by humans and humans cannot perform with hundred percent perfection, so there are strong chances of inoculation of human fallibilities in the software. To make the software free from these faults committed during the development and to achieve good quality trustworthy software, it is necessary to test the software thoroughly before delivering it to the customer. Software testing is a critical element of software quality assurance and represents ultimate review of analysis, design and coding. Increasing visibility of software as a system element and heavy costs associated with a software failure leads to well-planned thorough testing. A software development organization expends around 30-40 percent of total project effort on testing. Three major needs for software testing can be viewed in the Fig. 3.

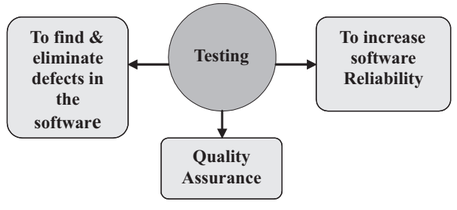


Fig. 3: Testing Needs

Defects

Defects are the errors, which are introduced in the software during the development phase. These errors appear in the software in the operational phase, i.e. when the software starts working. Occurrence of the software errors can cause the failure of the whole software. So, it is essential to find and eliminate these faults/errors in the testing phase. Fig. 4 [Grady 1994] shows a simple defect distribution, which illustrates eight causes of defects and their origin (indicated by shading) with the help of a pie chart.

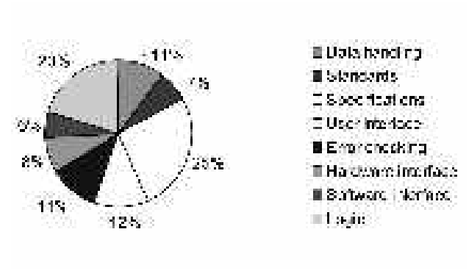


Fig. 4: Causes of Defects & their Origin

Software Quality Assurance (SQA)

SQA is an umbrella activity which is applied throughout the life cycle of the software development and which encompasses:

- Procedures for effective application of methods and tools.
- Formal technical reviews.
- Testing strategies.
- Procedures for assuring compliance to standards.

A useful categorization of factors affecting software quality was proposed by McCall et al., [1977]. These quality factors, shown in Fig 6 focus on three important aspects of a software product:

- Operational characteristics
- Ability to undergo change
- Adaptability to new environment

The quality factors are described in Fig. 5:

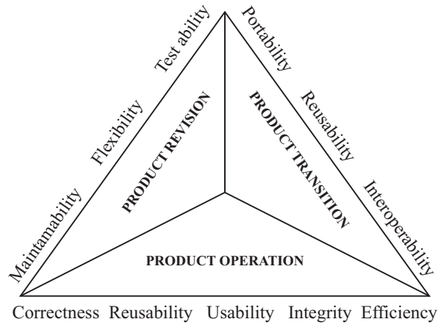


Fig. 5: Categorization of Quality Factors

Quality Factor	Description
Correctness	The degree to which a program satisfies its specification and fulfills the customer's needs.
Reliability	The extent to which a program can be expected to perform its intended function with required precision.
Efficiency	The amount of computing resources and code required by a program to perform its function.
Integrity	The extent to which access to software by unauthorized persons can be controlled.
Usability	The effort required to learn, operate, prepare input, and interpret output of a program.
Maintainability	The effort required to locate and fix an error in a program.
Flexibility	The effort required to modify an operational program.
Testability	The effort required to test a program to ensure that it performs its intended function.
Portability	The effort required to transfer a program from one software or software environment to another.
Reusability	The extent to which a program can be used in other applications.
Interoperability	The effort required to couple one system with another.

Software Reliability

It is obvious that the reliability of a software package is an important element of its overall quality. Software testing cannot guarantee cent percent correctness of the software because even after very rigorous and destructive testing, it may be possible that some errors are still left in the software. So, testing is a complementary method for decreasing the likelihood of the program failure, but yet it is an imperfect tool for fully assuring software correctness. Software Reliability is another approach, which reflects the degree of software correctness, and which can be used for enhancing software quality. Since the last 20 years, software reliability has been of considerable attention and has been accepted as a useful metric.

Software reliability is the degree to which a software package can execute its required function without causing system failures. Mathematically, we define software reliability as the probability that a software fault doesn't occur during a specified exposure period, in a specified environment. Thus

$$R(t) = P\{\text{no failure in the interval } (0,t)\}$$

From the above definition, it is clear that the measure of the software reliability is probabilistic in nature, where, the specified exposure period may be a single run, number of runs or time expressed in calendar or execution time units. Software reliability is a valuable measure to plan and manage the resources during the development process to develop high quality software. It also provides assurance to the user about the accuracy of the software. Scheduling and scheming the testing resources through the software reliability measure can be done by balancing the additional cost of the testing and the corresponding improvement in software reliability.

Testing Approaches

White-Box Testing: This is also known as glass-box testing. In this approach, the internal workings of the software are tested. The tests are performed to ensure that the internal components (procedures) of the software performance according to the requirements. It is based on close examination of procedural details. Logical paths within the software are tested by executing test cases that provide specific sets of conditions or loops. The program is examined at various points to determine whether the expected result corresponds to the actual ones. Precisely, white box testing ensures the following:

- All independent paths within a module are tested thoroughly.
- All logical decisions are tested on their true and false sides.
- All loops are tested at their boundaries and within their operational bounds.
- All internal data structures are tested to assure their validity.

Black-box testing: It is sometimes known as behavioral testing or partition testing. In this approach, the software is tested against the specified functions for which, it has been designed, without going into internal workings. The objective of this kind of testing is to make sure that the inputs in the software are accepted correctly and the outputs are produced properly. In other words, the Black box testing focuses on the functional requirements of the software and is conducted at the software interface. It attempts to find errors in the following categories:

- Incorrect or missing functions
- Errors in data structures or external database access
- Initialization and termination errors
- Performance errors
- Interface errors

Software testing strategies

It is now clear that the software testing is the most important phase in the whole cycle of software development. Therefore, the activities to be carried out in the course of testing process should be planned out beforehand. A set of steps or a strategy should be decided well in advance, which can act as a template for the testing process. A number of testing strategies have been proposed in the literature which suggest that the testing begins at the module level and works outward towards the integration of the entire computer-based system.

A typical strategy for software testing may be viewed as a spiral, illustrated in Fig. 6. At the vortex of the spiral, unit testing begins which focuses on each unit of the software as implemented in the source code. As we move outward along the spiral, we encounter integration testing where the concentration is on the design and construction of the software architecture. Then comes the validation testing where the requirements established during the requirement analysis phase are validated against the actual software that has been developed. Finally, the system testing is encountered where the software and other system elements are tested as a whole.

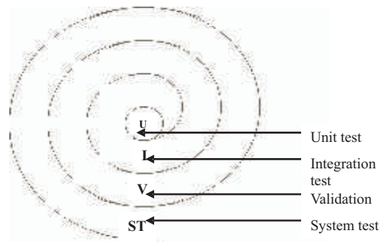


Fig. 6: Software Testing Strategy

Optimal software testing time

It is a good practice to invest as much time as possible in the testing phase so that the reliability can be increased. But increasing testing time, results in the increase in development costs and delay in the delivery of the software. On the other hand, decreasing the same might cause the unreliability of the product as well as an increase in the maintenance cost during the operational phase. Therefore, it is important to determine the threshold time at which, the testing should be stopped or the software be released so that required reliability could be achieved. The optimal software release problem (or optimal software testing problem) can be stated as:

Minimize EC(T)

subject to $R(x|T) \geq R_0$

where, EC(T) is the total maintenance cost of the software and R_0 is the minimum reliability to be ensured. Assuming c_t to be the testing cost per unit time, C_w to be the cost incurred in the warranty period and T_w to be the length of the warranty period, EC(T) can be given by

$$EC(T) = c_0 + c_t \int_0^{T_w} \exp(\quad t)dt + C_w(T)$$

$$EC(T) = c_0 + c_t$$

where is the discount rate of the cost

Fig. 7 shows the variation of software reliability with the testing time (T). It is clear from the figure that the reliability of the software increases with the testing time but after a particular time, the reliability becomes constant i.e., it cannot be increased further. The relationship between the Expected total cost EC(T) and the testing time for different values of a (initial number of errors) is depicted in Fig. 8. Kimura [1999] studied the problem of optimal testing time or software release time and obtained various software release policies. The results derived by him can be viewed in Table 1, which shows the dependence of c_t, and T_w on the optimal testing time.

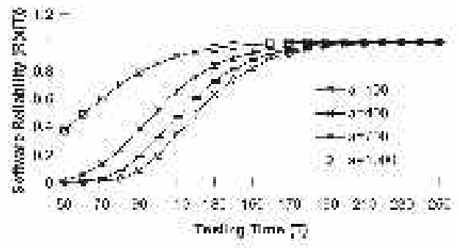


Fig. 7: Software reliability Vs. testing time

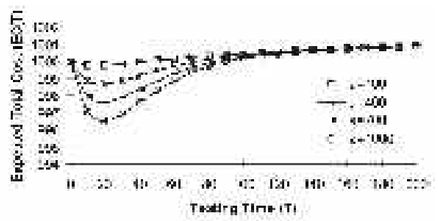


Fig. 8: Expected total Cost Vs. testing time

Table 1: Dependence of ct and Tw on optimal testing time

T_w \ C_t	1.0	3.0	5.0	10.0
1.0	107.7	107.7	107.7	107.7
5.0	110.8	107.7	107.7	107.7
10.0	124.7	107.7	107.7	107.7
20.0	138.6	116.6	107.7	107.7
50.0	156.9	134.9	124.7	110.8
100.0	170.7	148.8	138.6	124.7

Conclusion

In this article, the importance of the testing phase in the software development life cycle is discussed. Various issues related to software testing are presented and the need of software testing is conferred. Significance of quality assurance and software reliability in the software industry is also talked about. Finally the optimal time that should be invested on the testing is discussed and the variation of optimal testing time on various factors like software reliability, total maintenance cost of the software and initial no. of errors is shown with the help of graphs and numerical results.

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A Novel Product for Therapies: STEM CELLS

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Stem cells are one of the most interesting areas of research in biology today. These are pluripotent cells that have the capability to divide for long periods through cell division and regenerate in to specific cells. Stem cell are of different types such as embryonic stem cells, adult stem cells, hematopoietic stem cells, somatic stem cells, stromal stem cells. In laboratory they are growing on nutrient liquid media called as culture media and need special type of precaution during the cell culture process

"Emerging stem cell research has led to development of novel biodrugs," said A.N. Aditya, a research analyst at Frost & Sullivan, in a statement. Devastating In the face of extraordinary advances in the prevention, diagnosis, and treatment of human diseases illnesses such as, neurological therapies, bone and cartilage repair, cancer, cardiovascular disease, diabetes and other autoimmune disorders, wound healing and cell replacement for failing organs. While the field exudes a palpable momentum, few applications for stem cells will materialize until researchers first solidify their basic understanding of stem cell biology and learn to harness their differentiating capabilities.

Research on stem cells is accelrating knowledge about how an organism develops from a stem cell and how healthy cells replace damaged cells in adult organisms. This result oriented area of research is also leading scientists to investigate the possibility of cell-based therapies to treat disease, which is often referred to as regenerative or reparative medicine. Stem cells have two important characteristics that distinguish them from other types of cells. First, they are unspecialized cells that renew themselves for long periods through cell division. The second is that under certain physiological or experimental conditions, they can be doveloped in to cells with special functions such as the beating cells of heart muscle or insulin-producing cells of the pancreas.

Scientists primarily work with two kinds of stem cells from animals and humans: embryonic stem cells and adult stem cells which have different functions and characteristics. Scientists discovered ways to obtain or derive stem cells from early mouse embryos more than 20 years ago. Stem cells are important for living organisms for many reasons. In the 3- to 5-day-old embryo, called a blastocyst. Stem cells in developing tissues give rise to the multiple specialized cell types that make up the heart, lung, skin, and other tissues. In some adult tissues, such as bone marrow, muscle, and brain, discrete populations of adult stem cells generate replacements for cells that are lost through normal wear and tear, injury, or disease.

Scientists want to study stem cells in the laboratory so they can learn about their essential properties and what makes them different from As scientists learn more about stem cells, it may become possible to use the cells not just incell based therapies , but also for screening new drugs and toxins and understanding birth defects. Therefore, in order to develop such treatments scientists are intensively studying the fundamental properties of stem cells, which include:

1. determining precisely how stem cells remain unspecialized and self renewing for many years; and
2. identifying the signals that cause stem cells to become specialized cells.

Stem Cells with Unique Properties .

Stem cells differ from other kinds of cells in the body. All stem cells—regardless of their source—have three general properties: they are capable of dividing and renewing themselves for long periods; they are unspecialized; and they can give rise to specialized cell types.Scientists are trying to understand two fundamental properties of stem cells that relate to their long term self renewal :

1. why can emronic stem cell proliferate for a year or more in the laboratory without differentiating, but most adult stem cell cannot; and
2. what are the factors in living organisms that normally regulate stem cell proliferation and self-renewal?

Stem cells are unspecialized. One of the fundamental properties of a stem cell is that it does not have any tissue-specific structures that allow it to perform specialized functions. However, unspecialized stem cells can give rise to

specialized cells, including heart muscle cells, blood cells, or nerve cells.

Stem cells having the capability to divide for long periods. Unlike muscle cells, blood cells, or nerve cells—which do not normally replicate themselves—stem cells may replicate many times. When cells replicate themselves many times over it is called proliferation. A starting population of stem cells that proliferates for many months in the laboratory can yield millions of cells. If the resulting cells continue to be unspecialized, like the parent stem cells, they are said to be capable of long-term self-renewal.

An important area of research is understanding the signals in a mature organism that cause a stem cell population to proliferate and remain unspecialized until the cells are needed for repair of a specific tissue. Stem cells can give rise to specialized cells. When unspecialized stem cells give rise to specialized cells, the process is called differentiation. Scientists are trying to find out the pathway that trigger stem cell differentiation. The internal signals are controlled by a set of gene, which are lie among the long strands of DNA, and carry coded instructions for all the structures and functions of a cell. The external signals for cell differentiation include chemicals secreted by other cells, physical contact with neighboring cells, and certain molecules in the microenviorment

Adult stem cells typically generate the cell types of the tissue in which they reside. A blood-forming adult stem cell in the bone marrow, for example, normally gives rise to the many types of blood cells such as red blood cells, white blood cells and platelets.

Embryonic stem cells

Embryonic stem cell as their name suggests, are derived from embryos. Specifically, embryonic stem cells are derived from embryos that develop from eggs that have been fertilized in vitro—in an in vitro fertilization clinic—and then donated for research purposes with informed consent of the donors. They are not derived from eggs fertilized in a woman's body. The embroys from which human emronic stem cell are derived are typically four to five days old .

Adult stem cells

An adult stem cell is an undifferetiated cell found among differentiated cells in a tissue oran organ, can renew itself, and can differentiate to yield the major specialized cell types of the tissue or the organ. The primary roles of adult stem cell in a living organism are to maintain and repair the tissue in which they are found. Adult blood forming stem cells from bone marrow have been used in transplants for 30 years. Scientists in many laboratories are trying to find ways to grow adult stem cells in cell culture and manipulate them to generate specific cell types so they can be used to treat injury or disease. Some examples of potential treatments include replacing the dopamine-producing cells in the brains of Parkinson's patients, developing insulin-producing cells for type I diabetes and repairing damaged heart muscle following a heart attack with cardiac muscle cells.

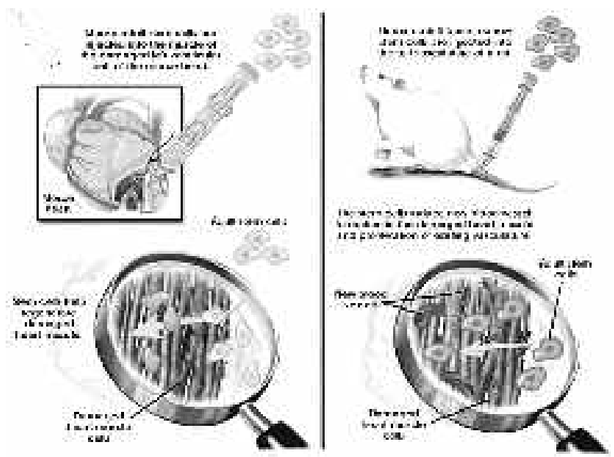


Figure 1. Heart muscle repair with.adult stem cells

In people who suffer from type I diabetes, the cells of the pancreas that normally produce insulin are destroyed by the patient's own immune system. New studies indicate that it may be possible to direct the differentiation of human embryonic stem cells in cell culture to form insulin-producing cells that eventually could be used in transplantation therapy for diabetics.

To be useful for transplant purposes, stem cells must be reproducibly made to:

- Proliferate extensively and generate sufficient quantities of tissue.
- Differentiate into the desired cell type(s).
- Survive in the recipient after transplant.
- Integrate into the surrounding tissue after transplant.
- Function appropriately during the recipient's life.
- Avoid harming the recipient in any way.

Stem Cells in Human Reproduction

The derivation of human embryonic stem (hES) cells heralds a new era in stem cell research, generating excitement for their therapeutic potential in regenerative medicine. Pioneering work of embryologists, developmental biologists, and reproductive medicine practitioners in in-vitro fertilization clinics has facilitated hES cell research. The identification of germ stem cells in the testis and the recent controversy over their existence in the ovary raise the possibility of harnessing them for treating young cancer survivors. There is also the potential to harvest fetal stem cells with pluripotent cell—like properties from discarded placental tissues. The recent identification of adult stem/progenitor cell activity in the human endometrium offers a new understanding of common gynecological diseases. Discoveries resulting from research into embryonic, germ, fetal, and adult stem cells are highly relevant to human reproduction

Stem Cell in Cosmetic surgery

Cosmetic surgery might be performed with stem cell generated natural tissues instead of synthetic implants. Saline and silicone implants for breast augmentation may rupture, leak, and interfere with breast cancer detection on mammograms. Stem cell generated natural tissue implants should avoid these problems.

Reconstructive surgery to replace tissues lost to cancer or other disease could benefit from stem-cell generated natural implants that do not shrink or lose their shape. Natural implants often require separate surgical procedures from a healthy location of the patient's body to obtain tissue for constructing the implant. The stem-cell approach does not require extensive surgery because cells needed for the implant are obtained in a less invasive needle procedure.

Type-1 Diabetes: In Children. Type-1 diabetes is an autoimmune disease characterized by destruction of insulin producing cells in the pancreas. Current efforts to treat these patients with human islet transplantation in an effort to restore insulin secretory function.

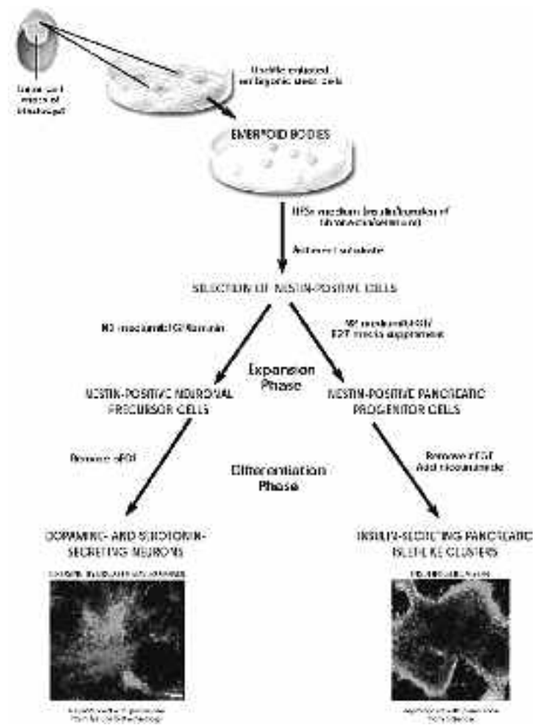


Fig 2. Development of insulin secreating pancreatic islet like cells from stem cells

Nervous System Diseases: In Parkinson's disease, nerve cells that make the chemical dopamine die. In Alzheimer's disease, cells that are responsible for the production of certain neurotransmitters die. In amyotrophic lateral sclerosis, the motor nerve cells that activate muscles die. In spinal cord injury, brain trauma, and even stroke, many different types of cells are lost or die. In multiple sclerosis, glia, the cells that protect nerve fibers are lost. Perhaps the only hope for treating such individuals comes from the potential to create new nerve tissue restoring function from pluripotent stem cells.

Primary Immunodeficiency Diseases: Pluripotent stem cells could be used in the treatment of virtually all primary immunodeficiency diseases these are among the most complicated diseases to treat with the worst prognoses. The immune deficiencies suffered as a result of acquired immune deficiency syndrome (AIDS) following infection with the human immunodeficiency virus are also relevant here. These diseases are characterized by an unusual susceptibility for infection and often associated with anemia, arthritis, diarrhea, and selected malignancies. However, the transplantation of stem cells reconstituted with the normal gene could result in restoration of immune function and effective normalization of life span and quality of life for these people.

Diseases of Bone and Cartilage: Stem cells, once appropriately differentiated, could correct many diseases and degenerative conditions in which bone or cartilage cells are deficient in numbers or defective in function. This holds promise for treatment of genetic disorders such as osteogenesis imperfecta and chondrodysplasias. Similarly, cells could be cultivated and introduced into damaged areas of joint cartilage in cases of steoarthritis or into large gaps in bone from fractures or surgery.

Cancer: At the present time, bone marrow stem cells, representing a more committed stem cell, are used to rescue patients following high dose chemotherapy. Unfortunately, these recovered cells are limited in their capacity to restore immune function completely in this setting. It is suggested that injections of properly differentiated stem cells would return the complete repertoire of immune response to patients undergoing bone marrow transplantation. Complete and functional restoration will be required if, for example, immune/vaccine anticancer therapy is to work. More importantly, success would permit the use of very toxic and effective chemotherapeutic regimens that could not currently be utilized for lack of an ability to restore marrow and immune function.

Uses in Research:

The use of stem cells for the testing of new medicines is another highly-anticipated application. Although certain cells are already utilized for this purpose – cancer cells, for example, are used to tests anti-tumor drugs – testing on pluripotent cells would open up this field to a much broader number of cell types.

A new window on human developmental biology: The study of human developmental biology is particularly constrained by practical and ethical limitations. Human ES cells may allow scientists to investigate how early human cells become committed to the major lineages of the body; how these lineages lay down the rudiments of the body's tissues and organs; and how cells within these rudiments differentiate to form the myriad functional cell types which underlie normal function in the adult. The availability of human ES cells will also greatly accelerate the understanding of the causes of birth defects and thus lead directly to their possible prevention. Models of human disease that are constrained by current animal and cell culture models. Investigation of a number of human diseases is severely constrained by a lack of in vitro models. A number of pathogenic viruses including human immunodeficiency virus and hepatitis C virus grow only in human or chimpanzee cells. ES cells might provide cell and tissue types that will greatly accelerate investigation into these and other viral diseases. Current animal models of neurodegenerative diseases such as Alzheimer's disease give only a very partial representation of the disease's process. Transplantation. Pluripotent stem cells could be used to create an unlimited supply of cells, tissues, or even organs that could be used to restore function without the requirement

For toxic immunosuppression and without regard to tissue matching compatibility. Such cells, when used in transplantation therapies, would in effect be suitable for "universal" donation. Bone marrow transplantation, a difficult and expensive procedure associated with significant hazards, could become safe, cost effective, and be available for treating a wide range of clinical disorders, including aplastic anemia and certain inherited blood disorders. This would be especially important in persons who lost marrow function from toxic exposure, for example to radiation or toxic agents. Growth and transplant of other tissues lost to disease or accident, for example, skin, heart, nervous system components, and other major organs, are foreseeable.

Gene Therapy. In gene therapy, genetic material that provides a missing or necessary protein, or causes a clinically relevant biochemical process, is introduced into an organ for a therapeutic effect. For gene-based therapies (specifically, those using DNA sequences), it is critical that the desired gene be introduced into organ stem cells in order to achieve long-term expression and therapeutic effect. Although techniques for delivering the therapeutic DNA have been greatly improved since the first gene therapy protocol almost 10 years ago, there are as yet no bona fide successes. Besides delivery problems, loss of expression or insufficient expression is an important limiting factor in successful application of gene therapy and could be overcome by transferring genes into stem cells Scientists have developed a way to produce a pure source of muscle cells, a technique that might one day prove useful for treating muscle-related diseases have used embryonic stem cells from mice to grow muscle cells. These same cells, injected into mice with a mild form of muscular dystrophy, formed healthy, functional muscle fibers at the site of deteriorating tissue.

In summary Stem cells is one of the most interesting therapies in diagnosis as well as in treatment of diseases such as, neurological disorders, bone and cartilage repair, cancer, cardiovascular disease, diabetes and other autoimmune disorders, wound healing and cell replacement for failing organs in man and animal today. The research was recently published in the online edition of A new method to boost growth of blood vessels with stem cells could improve cell therapies for diabetes and heart disease The tissue damage that accompanies many diseases, including the ulcers that occur in diabetes and the heart-muscle damage associated with cardiovascular disease, is linked to an inadequate supply of blood. Researchers are currently trying to determine whether adult stem cells derived from bone marrow can boost blood flow in these diseases by triggering growth of new vessels. Thus emerging stem cell research has led to development of novel biodrugs

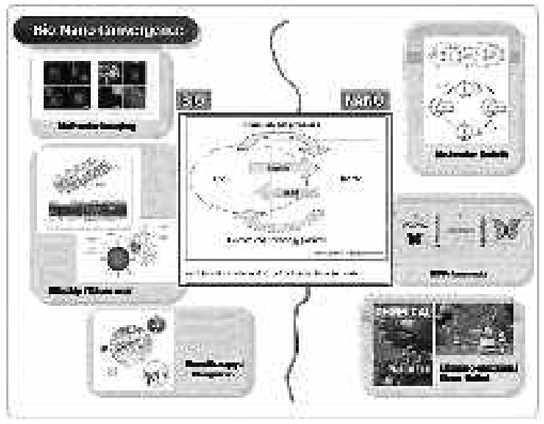
"The principle goal of education is to create men and women who are capable of doing new things, not simply repeating what other generations have done; men and women who are creative, inventive, and discoverers, who can be critical and verify, and not accept, everything they are offered."

Jean Piaget
French Psychologist and Educational Pioneer (1896-1980)

NANOTECHNOLOGY

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Nanotechology is a branch of science and engineering devoted to the design and production of extremely small electronic device and circuits build from individual atoms and molecules.It is emerging as one the most rapidly growing area of science and technology with application in biology , Physics, material science Chemistry and earth sciences. Scientists claim that even with in the next 50 years, this new technology will change the world in ways we can barely begin to imaging today.Nano comes from the greek word for small and is used to indicate one billionth or 10-9 power. Nano science involves manipulating particle at the atomic level to from new compounds or to make change to existing substances.



Nanobiotechnology is an emerging field of research at the crossroads of biotechnology and nanoscience, and involved in many different disciplines, including physicists, chemists, engineers, information technologists, and material scientists, as well as biologists. Nanoscale materials (nanoparticles, nanopores, nanoshells, nanostructures, etc) allow highly sensitive detection by specific interactions with various biomolecules on both the surface and inside cells, and thereby many biologists have concerned the utilization of these nanomaterials. We are focusing on development of nanobiotechnologies and nanobiochips to analyze biomolecular interactions and to detect disease biomarkers in a high-throughput way with high sensitivity and specificity in biological systems.

History of Nanotechnology

The concept of nanotechnology had its genesis in a lecture by physicist and former cornell professor Richard P Feunman (1918-1988) to American Physical Society in 1959 titled "Theres plenty of room at the bottom" Though he never used the term nano technology.The term nanotechnology was coined in1979 by Tokyo Science University professor Norio Taniquchi to describe precIsion manufacturing of material at the nanometer level.In 1986, K Eric Drexler wrote engines of creation the Coming Era of Nanotechnology,a work that introduced the public to the wider possibilities in the field. He talked about building machine on the scale of molecules., few nanometer wide – motors , robot , arms, and even whole computers, even smaller than a cell. As technology developed the ability to build simple structure on a molecular scale , nanotechnology became an accepted concept. Soon the U.S. national nanotechnology intiative was created to fund this kind of nanotech. Drexler taught the first course on the subject at Stanford university in 1988.Progress in Nanotechnology is being made in many laboratories around the world, notably in the U.S, Japan and Europe. These fields of work have been seen as most relevant like:Protien design , biomimetic chemistry and atomic imaging and positioning, major advances in protein design have been made in the last two years.

The Assembler

But how do scientists visualize assembling atoms and molecules to make devices ? To get every atom in the right place, we need a machine called the assembler. The assembler can force sight – specific chemical reaction.To find structure constistent with the laws of chemistry and physics, we must use molecular modeling softwares.
To reduce manufacturing cost, we may need to develop some type of replication for the assemblers .

A self replicating assembler would work by using its ability to make site specific chemical reaction to make copies of it self. These copies can then make copies of themselves, and so on. Eventually, the assembler multitude can then work in parallel to build molecular structures. This massive parallesism leads to great economies of scale. These assemblers can be compared to the molecular machinery, evident in cells today, for example, a seed can be seen as the instruction to create a vast structure of cellulose such as a redwood tree on the other hand in something as simple as a potato plant. With the right instructions, an assembler could make products in an analogous way. In computer industry ability shrink the size of transistors on silicon micro processes will soon reach its limits, Nanotechnology will be needed to create a new generation of computer components. Molecular computers could contain storage device capable of storing trillions of bytes of information, in the structure the size of sugar cube.

Assembler – based manufacturing will enable the construction of extremely small computers. The equivalent of modern mainframe computer could fit into a cubic micron, a volume far smaller then that of a single human cell. Once such nanocomputer have been designed and the technology is in hand, building them will be in expensive enabling us to use many of them at once. A laptop computer could then have more power then all the computers in the world today put together.Another promising scenario is with relation to using natural resources judiciously. Rather than clear cutting forests to make paper, it is possible to have assemblers for synthesizing paper, Rather than using oil for energy, it will be better to have molecular sized solar cell mixed into road pavment. With such solar nanocells, a sunny patch of pavment of few hundred miles could generate enough energy for various uses.

Nanotechnology's use for Environment

Nanotechnology could have a positive effect on the environment as will building device at the molecular level means products would be smaller minimizing waste and also leading to less waste in the production process and in the trash , when nano device discarded at the end of their lives. The overall trand would be towards suitable development .
Nanotechnology could even help repair some of the damage that human have infected on the environment. for instance, air borne nanorobots could be programmed to rebuilt the thinning ozone layer. Contaminants could be automatically removed from water sources, and oil spills could be cleaned up instantly .

Nanotechnology may have its biggest impact on the medical industry. The technology is widely recognized as a great opportunity for disease prevention (eg improved food safety) early disease detection (e.g sensors for cancer detection) or medical treatment(e.g controlled drug delivery by nano capsules).It could also mean the end of diseases, for instance, if some body suffered from cold and fever, he/she would just have to drink a tea spoon of liquid containing an army of molecules – sized nano robots programmed to enter into the body"s cell and fight viruses. In case of genetic diseases, the patient would have to inject nano robotes that would burrow in to the DNA and repair the defective gene. The technique could even eliminate traditional plastic surgery, as medical nano robots could change one"s eye colour,alter the shape of the nose, or even give a complete sex change with out surgery .

NanoTechnology In Agriculture

Nanotechnology has not left agriculture untouched .Nanotechnology promises to revolutionize the agriculture sector with new tools for molecular treatment of plant diseases, rapid detection of diseases,enhancing the ability of plants to absorb nutrients thus increasing soil fertility and crop productivity .In agriculture, the fundamental life processes are explored thought research in molecular and cellular biology.New tools for molecular and cellular biology are needed that are specifically designed for separation , identification and quantification of individual molecules .This is possible with nanotechnology and could permit broad advances agriculture research, such as reproducative sciences and technology, conversion of agriculture and food wastes to energy and other useful by products thorough enzymatic nano processing ,diseases prevention and treatment in plant and animal.

Smart seasons that can detect abnormal physiological health of a plant due to disease incidence and smart drug delivery

system will help the agriculture industry combat viruses and other crop pathogens nanotechnology will also protect the environmental industry through the use of renewable energy supplies and filters of catalysts to reduce pollution and clean up existing pollutants.

Smart treatment delivery system

Today application of agricultural fertilizers, pesticides, antibiotics, probiotics and nutrients is typically through spray an drench application to soil or plants or through feed or injection system to animals .Delivery of pesticides or medicines is either provided as preventive treatment , or is provided once the disease organism has multiplied and symptoms are evident in the plant or animal.Smart delivery systems can also have the capacity to monitor the effect of the delivery of pharmaceuticals, nutrients, food supliments, bio active compounds , probiotics chemicals , insecticides , fungicides , vaccination or water to people , animals plants, insects, soil and the environment .

Nano Bio processing

Bio processing is the use of natural biological processes to create a desired compound or material from a defined feed stock , such as compost material form plant and animal wastes. Nanobio processing will focus on and utilize nano scale technology to achieve the goal of bio processing with greater efficiency. The use of molecular probes or the developemnt of devices that allow rapid identification of microbes present in a feed stock are example of research at the nano scale, that can increase the efficiency of bioprocessing .

Nucleic acid bioengineering

Many of the nanotechnology devices of today have been fabricated from pieces of silicon or other materials through etching , much like sculpting away portions of the beginning material block to obtain the final structure. Nucleic acid engineering utilize DNA molecules as building block and from specially shaped particles . such as nano wires and nano membranes that can be used to build larger units, Nucleic acid engineering is a plate from technology that can find a mixed of application for agriculture and food system through the development of novel material.

Nanotechnology for Soil Managment

A Number of project around the world are exploring the use of nano particles to modify the impact of agriculture on the environmental, such as soil managements and clean up the pollutants.

Soil binder – 'Soil set' is the first nanotech based soil binder developed by Sequioa pacific research of Utah (USA), soil set is a quick setting mulch , which relies on chemical reaction on the nano scale to binds soil together.this soil binder can be used in mountain area to prevent soil erosion.

Ground water clean up

Nano membrane can be used for water purification, desalination and detoxification. The US company Argonide is using 2nm diameter aluminum oxide nano fiber (nano cream) as a water purifier. Filter made form these fiber can remove viruses, bacteria and protozoan cyst form water.

Magnetic nano particles and magnetic nano spheres coated with different compounds that have a selective affinity for diverse contaminating substance can be used to remove pollutants from water. for example nano magnets coated with chitosan can be used remove oil and other organic pollen from aquous environment.

Nanotechnology has vast potential in every walk of life and this technology has the potential to revoutinize the future of mankind and earth.

Tattoos could be future Vaccines

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A tattoo can be more than just a fashion statement. Tattooing is an invasive procedure done with a solid vibrating needle causing a wound and sufficient inflammation to prime the immune system

The tattoo of future may be good for your health rather than just your image. German scientists said that work on mice showed that tattooing was more effective way to deliver a new generation of experimental DNA vaccines than standard injections into muscle . '

They believe tattooing promises better vaccines for everything from flu to cancer. However the concept has been hampered by its low efficiency. Using a coat protein from the human papillomavirus or HPV the cause of cervical cancer as a model DNA vaccine antigen.Martin Muller and his team at Deutsches Krebsforschungszentrom.Heidelbery Germany , compared delivery by tattooing the skin of mice with standard intramuscular injection with & with out the molecular adjuvant that are after given to boost immune response .

The researchers found that tattoo method gave a stronger humeral (antibody) response and cellular response than intramuscular injection even when adjuvant were included. Three does of DNA vaccines given by. Tattooing produced at least 16 times higher antibody levels than three intramuscular infections with adjuvant. The adjuvant enhanced the effect of intramuscular infection but not of tattooing.

Tattooing covers a bigger area of skin than an infection so the DNA vaccine can enter more cells. These effect might account for the stronger immune response arising from introducing a DNA vaccine into the body by tattooing. The researchers said that tattooing approach might not be to ever one's taste as it likely to hurt but they believe that it could have a role in for instance routine vaccination of cattle or in delivering therapeutic vaccines to humans . Muller said vaccination with naked DNA has been hampered by its low efficiency .Delivery of DNA via tattooing could be a way for a more widespread commercial application of DNA vaccines .
Using fragments of DNA to stimulate an immune response is seen as a promising way of making better vaccines for everything from flu to cancer. Delivery of DNA via tattooing could be a way for a more wides pred commercial application of DNA vaccines.

The far stronger response reflects the fact that giving a tattoo with a vibrating needle causes a wound and inflammation. As a result, the tattoo – measuring around 1 centimeter square is more painful but more efficient than a normal injection. This is probably what makes it work better than normal infection because the tissue is damaged and this affects the immune cells which than look out for antigens.

Tattoo injections are thought to be more effective because the repeated puncturing of the skin by rotating tattoo needle does real damage to the skin the presence of a bona died wound causes inflammation cells to food into the site where they speed and enhance the immune response to the vaccines .
DNA vaccines can be grown in bacteria an approach that makes it possible it s produce DNA vaccines in large quantities and much faster than current procedure the use of tattoo injection coupled with the ability to rapidly produces large quantities voluble in a situation such as a threatened terrorist attack where a sudden need arises for large amount of an effective vaccines.

Hence, tattoos may be tomorrow's vaccines.

REACTION OF INDIANS - WHO WILL GAIN AND WHO WILL LOSE?

(A STUDY OF FRINGE BENEFIT TAX IN AN INDIAN PERSPECTIVE)

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ABSTRACT

The imposition of fringe benefit tax that proposes to tax companies on perquisites provided to their employees by Finance Minister P Chidambaram in his recent Budget has sparked off a huge debate amongst corporate and tax circles. Fears have been aired that many an industry will be badly hit by the fringe benefit tax and act as a barrier to their growth and well being. This paper examines the reason of introducing finge benefit taxes, how badly will it hurt corporate India, what expenses come under this tax, who pays fringe benefit tax, what is the reaction of India inc to fringe benefit tax, Payment of fringe benefit tax , How will the fringe benefit tax be calculated & Payment of fringe benefit tax

Introduction:

Fringe Benefit Tax may seem new to India, but it's not a novel concept. This tax is already levied in the United States, the United Kingdom, Canada, Australia, New Zealand, Japan and some other nations.The fringe benefit tax rules proposed in the Budget by the finance minister are modeled on the Australian system. With the only difference that fringe benefit tax is proposed to be taxed at between 10 per cent and 50 per cent in India, whereas in Australia it is taxed at a flat rate of 60%.

What is Fringe Benefit Tax?

The taxation of perquisites or fringe benefits provided by an employer to his employees, in addition to the cash salary or wages paid, is fringe benefit tax. Any benefits or perks that employees (current or past) get as a result of their employment are to be taxed, but in this case in the hands of the employer. This includes employee compensation other than the wages, tips, health insurance, life insurance and pension plans.Fringe benefits as outlined in section 115WB of the Finance Bill, mean any privilege, service, facility or amenity directly or indirectly provided by an employer to his employees (including former employees) by reason of their employment. They also include reimbursements, made by the employer either directly or indirectly to the employees for any purpose, contributions by the employer to an approved superannuation fund as well as any free or concessional tickets provided by the employer for private journeys undertaken by the employees or their family members.

Reason For Introducing Fringe Benefit Tax:

Attribution of the personal benefit poses problems, or for some reasons, it is not feasible to tax the benefits in the hands of the employee, thereby , it was proposed to levy a separate tax known as the fringe benefit tax on the employer on the value of such benefits provided or deemed to have been provided to the employees

Who pays fringe benefit tax?

Under the proposed provisions, fringe benefit tax is payable by an employer who is either an individual or a Hindu undivided family engaged in a business or profession; a company; a firm; an association of persons or a body of individuals; a local authority; a sole trader, or an artificial juridical person. The tax is payable in respect of the value of fringe benefits provided or deemed to have been provided by an employer to his employees during the previous year. The value of fringe benefits so calculated, is subject to additional income tax in respect of fringe benefits at the rate of thirty per cent, as provided in section 115WA. The fringe benefit tax is payable by the employer even where he is not liable to pay income-tax on his total income computed in accordance with the other provisions of this Act. The benefit does not have to be provided by the employer directly for him to attract fringe benefit tax. fringe benefit tax may still be applied if the benefit is provided by a third party or an associate of the employer or by under an arrangement with the employer.

How will the fringe benefit tax be calculated?

The value of fringe benefits shall be the aggregate cost incurred. That is, the total expense deducted will be considered for purposes of levying fringe benefit tax. From this, a certain percentage will be deducted. The difference therein will be taxed at the rate of 30%. However, the fringe benefit tax rate varies from 10 per cent to 50 per cent depending upon the expense incurred:

For example, for the use of telephones 10 per cent fringe benefit tax will be charged, while entertainment expenses, festival expenses, gifts, use of club facilities, etc will be taxed at the rate of 50 per cent.

The Fringe Benefits Tax should be disclosed as a separate item after determining profit before tax on the face of the profit and loss account for the period in which the related fringe benefits are recognised. An illustration of the disclosure of Fringe Benefits Tax may be as below:

Profit before tax				xxx
Less: Income-tax expense:				
	Current tax	xxx		
	Deferred tax	xxx	xxx	
	Fringe Benefits Tax		xxx	xxx
Profit after tax				xxx

Items of fringe benefits that will be taxed?

As per the Finance Bill, fringe benefits shall be deemed to have been provided if the employer has incurred any expense or made any payment for the purposes of:

(a) entertainment;
(b) festival celebrations;
(c) gifts;
(d) use of club facilities;
(e) provision of hospitality of every kind to any person whether by way of food and beverage or in any other manner, excluding food or beverages provided to the employees in the office or factory;
(f) maintenance of guest house;
(g) conference;
(h) employee welfare;
(i) use of health club, sports and similar facilities;
(j) sales promotion, including publicity;
(k) conveyance, tour and travel, including foreign travel expenses;
(l) hotel boarding and lodging;
(m) repair, running and maintenance of motor cars;
(n) repair, running and maintenance of aircraft;
(o) consumption of fuel other than industrial fuel;
(p) use of telephone;
(q) scholarship to the children of the employees.

In cases where the employer is engaged in the business of carriage of passengers or goods by motor car or by aircraft, a lower percentage of expenses on repair, running and maintenance of motor cars or aircrafts or fuel expenses has been specified.

Similarly, for hotels, a lower percentage of the expenses incurred on hospitality has been specified for purposes of calculating the liability under the fringe benefit tax.

An employer liable to pay fringe benefit tax is required to furnish a return of fringe benefits before the due date as given in section 115WD.
Section 115WE outlines the procedure for the assessment of the return of fringe benefits filed by the employer and the determination of tax or interest payable or refund due and in either case the issue of intimation to that effect.

Tax rate of fringe benefit ?

According to P. Chidambaram's announcement in the Lok Sabha, a FBT of 30% will be levied on 20% of the fringe benefit expense. In simpler terms, FBT will work out to be 6% of the total amount.

But in end, the effective FBT turned out to be just 2% for regular companies and 0.5% for special-category companies like IT and pharmaceuticals. What's more, India Inc can avoid

paying even this minuscule amount of tax if their auditors certify an expense as a genuine business expenditure. According to industry sources, there will be 1.5 to 2% additional tax burden to companies due to items covered under FBT account for about 10-15% of total corporate profits.

Payment of fringe benefit tax

115WI. Notwithstanding that the regular assessment in respect of any fringe benefits is to be made in a later assessment year, the tax on such fringe benefits shall be payable in advance during any financial year, in accordance with the provisions of section 115WJ, in respect of the fringe benefits which would be chargeable to tax for the assessment year immediately following that financial year.

Who will gain and who will lose

The taxation of perquisites -- or fringe benefits -- provided by an employer to his employees, in addition to the cash salary or wages paid, is subject to varying treatment in different countries. These benefits are either taxed in the hands of the employees themselves or the value of such benefits is subject to a 'fringe benefit tax' in the hands of the employer. The rationale for levying a fringe benefit tax on the employer lies in the inherent difficulty in isolating the 'personal element' where there is collective enjoyment of such benefits and attributing the same directly to the employee. This is so especially where the expenditure incurred by the employer is ostensibly for purposes of the business but includes, in partial measure, a benefit of a personal nature. Moreover, in cases where the employer directly reimburses the employee for expenses incurred, it becomes difficult to effectively capture the true extent of the perquisite provided because of the problem of cash flow in the hands of the employer. Therefore, the finance minister has proposed to adopt a two-pronged approach for the taxation of fringe benefits under the Income-tax Act.

Perquisites which can be directly attributed to the employees will continue to be taxed in their hands in accordance with the existing provisions of section 17(2) of the Income-tax Act and subject to the method of valuation outlined in rule 3 of the Income-tax Rules.

In cases, where attribution of the personal benefit poses problems, or for some reasons, it is not feasible to tax the benefits in the hands of the employee, it is proposed to levy a separate tax known as the fringe benefit tax on the employer on the value of such benefits provided or deemed to have been provided to the employees.

For this purpose, a new Chapter XII-H is proposed to be inserted in the Income-tax Act containing sections 115W to 115WL, which provides for the levy of additional income tax on fringe benefits.

The chapter is divided into three parts. Part A contains the meaning of certain expressions used, part B enumerates the basis of charge, and part C delineates the procedures for filing of return in respect of fringe benefits, assessment and the payment of tax thereon.

Fringe Benefits – Hurts badly to corporate India.

Reports suggest that the fringe benefits tax is likely to result in India Inc incurring an additional expenditure of about Rs 25,000 crore.

Fringe benefit tax – Hitting advertising agencies .

The 30 per cent fringe benefit tax will hurt advertising agencies badly as in this sector about 10% to 12% of an employee's salary comes in the form of perks.

In the glamorous world of advertising attending conferences all over the world, wining and dining to network with clients and bag more business, etc is the done thing. Now all these expenses will come under the ambit of fringe benefit tax. Also, advertising agencies are people-oriented one and staff welfare and salaries account for almost 50 per cent of their expenses. The fringe benefit tax will thus hurt ad agencies badly.

Indians reaction about fringe benefit tax?

India Inc is quite nervous about the proposed fringe benefit tax and feels that the gains from the reduction in corporate tax announced in the last Budget would be nullified by the cut in depreciation rates. Nearly 70 per cent of the CEOs surveyed in the Associated Chambers of Commerce and Industry's Business Barometer survey were happy with the reduction of the corporate tax from 35 per cent to 30 per cent, while 57 per cent out of them were of the view that the gains from the corporate tax reduction will be nullified because of the cut in the depreciation rates. Most of the CEOs surveyed said that the impact of the fringe benefit tax would be 'most severe' on Indian enterprises. They argued that advertisement and sales promotion expenses should not be included under fringe benefit tax. The survey also pointed out that the cash withdrawal tax would be a big blow for small retailers and dealers. However, 30 per cent of the respondents said that since the surcharge has also been increased from 2.5 per cent to 10 per cent, the overall benefit of the corporate tax reduction was only around three per cent. Some software firms feel that a wide variety of payments would come under the ambit of fringe benefit tax. A recent survey also said that because of the impact of the fringe benefit tax, companies across sectors are likely to cut down on the increments that employees would get. The proposal has invited criticism even from the Institute of Chartered Accountants of India, which has otherwise praised the finance minister for rationalising the tax administration.

Conclusion:

Therefore, from the above we can clearly understand the reason why the center(Finance Ministry) has enacted this Fringe Benefit Tax. This will surely act as a boon as this tax is nothing but an economic security measure that is enhanced by the Government in order to achieve the equality and also increase the government fund through a rightful mean. Most of the CEOs surveyed said that the impact of the fringe benefit tax would be 'most severe' on Indian enterprises. They argued that advertisement and sales promotion expenses should not be included under fringe benefit tax. The survey also pointed out that the cash withdrawal tax would be a big blow for small retailers and dealers. Hence, FBT is constitutionally valid and the assessee who is getting benefits will have to bear burden of fringe benefit taxes. Whereby, its time for the Government to make clarifications as to the doubts that has raised in the application of FBT.

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"I saw as a teacher how, if you takethat spark of learning that those children have, and you ignite it, you can take a child from any background to a liftime of creativity and accomplishment."

Paul Wellstone
American Senator and Educator, 1944-2002

The Biotechnology age today:

scope, career opportunities & future prospects

Dr. PK Shukla and Dr. Pragati Shukla, Sr. Lecturer, Deptt. of Biotechnology

Biotechnology is one of the most exciting new sciences of this century! The discovery that DNA (deoxyribonucleic acid), the carrier of the genetic code for any form of life, can be transferred into any other form of life opens the door to a multitude of possibilities for genetically modified plants, animals, and microbes not found on earth-until now. Biotechnology is an interdisciplinary science including not only biology, but also subjects like mathematics, physics, chemistry, computers and engineering. It is a blend of various technologies applied together to living cells for production of a particular product or for improving upon it. Biotechnology has produced new products and processes in a number of economic sectors including agriculture, food processing, chemical and pharmaceutical industries, pesticides, detergents, feed stocks, recycling, and waste treatment. Biotechnology has advanced rapidly in industrial countries. Biotechnology has served many people as a career.

Biotechnologists are employed in the research and development departments of pharmaceutical and fermentation companies, horticulture, food science, commerce, healthcare technology and teaching. Many are involved in molecular biology research and data processing posts in academic, governmental and research institutes. Others work in hospital research, diagnostic laboratories, and in administrative capacities in the civil service and government agencies. Some biotechnologists move into scientific writing and journalism, or into quality assurance management, sales and marketing, some are engaged in business. A career that is impacted by biotechnology is not just a job. It is an invitation to participate in the development of new products and processes that could improve the quality of human life as much as any other discovery since the Industrial Revolution. Welcome to the "Biological Revolution"!

CAREER PROSPECTS

In recent times, biotechnology as a subject has grown rapidly. And as far as employment is concerned, it has become the second fastest growing sector after multi-media. Candidates with postgraduate degree in biotechnology get absorbed in corporate and government sector, both. Qualified biotechnologists are employed in leading Indian business houses and MNCs including pharmaceutical companies, chemical industries, bioprocessing industries, agriculture related industries and pollution control activities of the major industries etc. They can even join government and corporate run research and development organizations

PROMISING FIELDS FOR A BIOTECHNOLOGIST

There are some career directions that remain hot today and ever. Although there have been some significant changes, particularly in the core technologies used in certain sectors. Development, operations and biotech business jobs remain very strong, however. There are many institutes or companies, which are successfully progressing in bringing products to market still by using basic sciences. Second-generation biotech firms with antisense or receptor technologies that have products in early clinicals. These "new biotechnologies" aid in developing treatments for known illnesses, but they will also help to combat new and emerging diseases." Here are some most promising fields in Biotech, listed down:

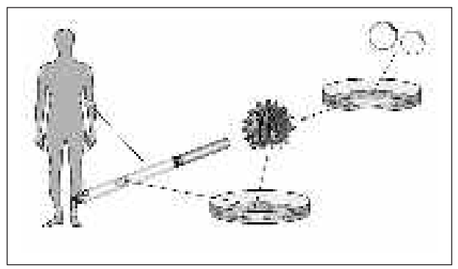
Medicine and health care

Biotechnology's application in this area has helped in the development of various medicines, vaccines and diagnostics. The remarkable development work carried out by biotechnologists in this field has led to improvement in the methods of diagnosis, medicines and vaccinations for diseases which once thought were incurable are no more a cause of worry, which has been a blessing for humankind. Vaccine production will take another shape after the successful trial and commercialization of DNA / RNA vaccines, recombinant DNA as vaccine etc.



Gene therapy

This is one of the most recent techniques. Human beings suffer from more than 5000 different diseases caused by a single gene mutation. It involves the molecular biotechnological technique of correcting genetic disorders by replacing defective genes with functional or normal gene. The technique may be somatic gene therapy or germ line gene therapy. The technique involves lots of ex-vivo and in-vivo trials at each level of development. Although, gene therapy has so far been marginally successful, but development and application of new vectors is likely to increase the success rate. The slow process involves - understanding gene function, gene targeting and curing. The technique involves hard-core R&D and cost. Manpower involved should be highly trained and qualified.



Clinical Research

This is a huge category of positions and career tracks. A strong future is easily forecast over the next decade for those with careers in the clinical side of biotechnology. Although it is certainly true that our industry can't support 1500 biotech companies in this country, we may have trouble even supplying one-third of that group with CRAs.



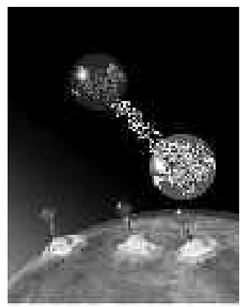
Drug Discovery

This approach aims at discovery and sometimes drug designing, which specifically fit into the target molecules. These scientists often have hybrid backgrounds, which include molecular biology, cell biology, and exposure to today's hot biotech technologies like gene therapy or antisense. Because the category of "discovery scientist" is a broad and difficult-to-classify area, careers can come up through a number of disciplines.



Formulations and Drug Delivery

This is another career choice that can be quite multidisciplined, both chemists and engineers are found in this category. Generally, a Ph.D., Pharmaceutical Chemist or Biochemist with experience in formulation chemistry and/or drug delivery technologies (Le. controlled release) will have no problem in the job market. The technology involves tremendous R&D plus clinical trials. There are very few academic institutions that teach these special skills, and it is a supply and demand job market.



Plant Engineering

Indian economy is very much dependent on agriculture and biotechnologists have made major advancements in this area. Biotechnology is currently catalyzing another green revolution by allowing crops to be identified, selected, and even created that are more resistant to pests, bacteria, fungi, virus and drought etc. We can also device techniques and tools that ensure beneficial agriculture like tissue culture and transgenic approach. Over the years, the agricultural output has been improving, owing to the improvements in the quality of seeds, insecticides and fertilizers. The latest technologies like micro propagation and tissue culture has further helped agriculturists to overcome problems like soil imbalances, genetic breeding and crop diseases. Biotechnologists are also encouraging a shift from chemically prepared fertilizers and insecticides to biochemicals and bioinsectisides that are more eco-friendly.



Animal husbandry

Biotechnology's intervention in the area of animal husbandry has improved animal breeding. Numerous kinds of genetically engineered, high yielding animal breeds have come up which has increased the output of dairy products as well as the meat products. India has in fact, become the largest milk producer in the world. It is seemingly having a great future ahead.



Environment

Environmental biotechnology has become another area of extensive work due to the dangers brought about by increasing levels of environmental pollution. A lot of hard work is being done to protect our environment. In this field, the job of a biotechnologist spans from checking industrial pollution (water, soil, water) levels, treatment of industrial waste to recycling of sewage sludge by modern biotechnological applications like enzyme or whole cell immobilization. Scientists are also devising methods for conversion of industrial waste into biofuels and other useful products. The detection of environmental pollution has been made easy by biotechnological methods.

Industrial research and development

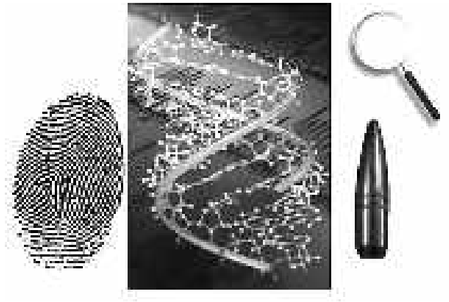
Both the government and the private sector employ biotechnologists. They conduct research and development work, for increasing productivity, improving energy production and conservation, minimizing pollution and industrial waste etc. Biotechnologists also find opportunities at places involving activities like chemical processes, genetic engineering, textile development, cosmetic development etc.



Forensic Biotechnology

Biotechnology has provided law enforcement professionals with another way of placing a suspect at the scene of a crime. This area of study, called forensic biotechnology, uses a method called DNA fingerprinting. This method is based on the fact that each individual's DNA is highly unlikely to be identical to any other person's DNA (unless he or she has an identical twin).

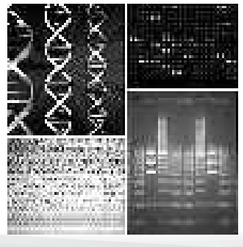
By examining traces of tissue, hair, tooth pulp, blood, or other body fluids left at the scene of a crime, a suspect can be linked to a crime location with great accuracy. Many states are now accepting DNA fingerprinting results as admissible evidence in criminal and civil trials.



Bioinformatics

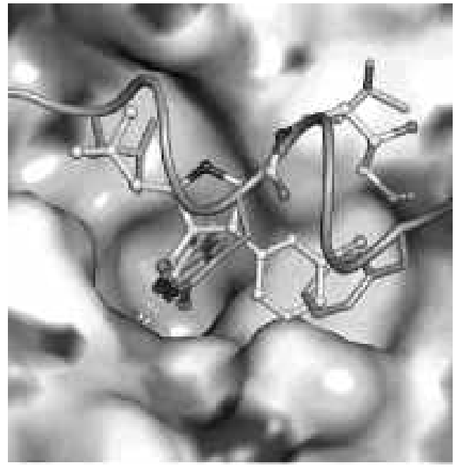
Structural biology, computational chemistry, mathematics and a love of computing combine in one of the most "difficult to fill" positions of them all. As the computer becomes a stronger tool in modeling complex structures or processes, biocomputational specialists may learn to make simpler molecules that produce the same end results.

Linda St. James, Search Masters International, specializes in those positions that go beyond basic science and support implementation in the clinic: "It's exciting to work with companies who are getting closer and closer to putting a new drug on the market. We see lots of opportunities for chemists and biochemists to tackle fresh problems in order to deliver therapies that few of us barely conceived of a decade and a half ago. The most "in demand" profession would have to be clinical research, though, which is so key to bringing products successfully through the FDA and to the market", as they



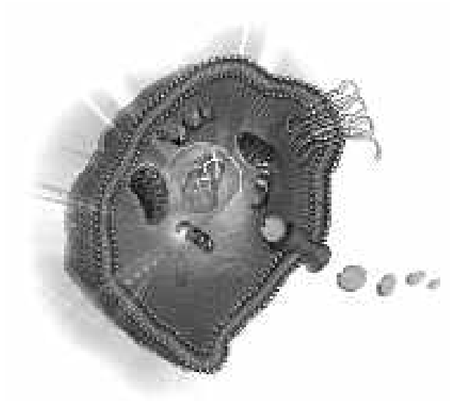
Receptor Biology

Another of the multi-disciplined areas where specific disciplines can be blurred: Examples of healthy job categories include Receptor Biochemists, Molecular Biologists with experience in receptors and their ligands, and Cell Biologists with experience in G protein-coupled receptors and a strong base in cell and molecular biology.



Cell Biology

New fields of research in the cell therapy and tissue engineering sectors combine with the continuing need for mammalian cells as a production system for proteins. Cells are the engines and brains of many processes, and the biologist who understands these new frontiers is on the cutting edge of the job market. Like all of these positions, a scientist with previous industrial experience is preferred when it comes to extending an offer.



Bioanalytical Chemistry

Analytical chemistry has long been relegated to the QC lab in traditional industries. In biotechnology, however, those who develop and validate the critical assays needed by both R & D and clinical manufacturing teams are in strong demand. Judging by the number of open positions in this field, this will continue.



Bioprocess Engineering

Scale-up of bioproducts is still a hot topic in the job market. This career choice is helped along by the growth in the non-medical areas of biotech, which consultant Roger Shamel of Consulting Resources says will double as a percentage of overall biotech sales in the next ten years .The products offered by this industry are enormous and economically beneficial e.g. biochemicals, biopesticides, enzymes, primary or secondary metabolites, SCP, neutraceuticals, organic acids, food etc. This field involves lots of other job offering fields like protein engineering, drug designing, metabolic engineering etc. The person involved should be highly skilled and technical.

Joe McMahon, Management Recruiters, advises that his client companies are all running bio-manufacturing operations. They say, "For us, the hot positions are those in which organizations are taking products into the scale up or manufacturing mode. We've been watching growth in areas like downstream processing, utility and project engineering, and validation and believe that they will continue to represent strong career choices."



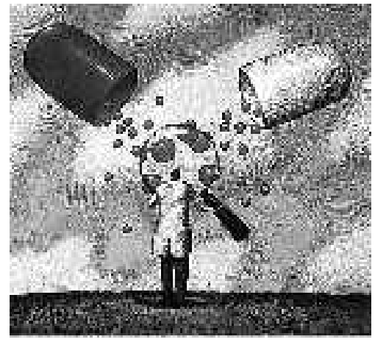
Validation and Regulatory Compliance

A biotechnologist can develop a validation career with a life sciences background, an engineering degree, or as one key manager says, "Any kind of degree as long as they have a proclivity for detail works." Ask a validation specialist how many calls he or she had in the last week from headhunters and you'll get a feel for what the future holds for these folks.



Regulatory Affairs

This is another field for which there is no direct route out of academia, so disciplines and degree levels can vary widely. Despite which biotech technology sector we are referring to, there remains a solid growth for regulatory people at all levels. Most in- demand is those senior professionals with a combination of large and small company experience, preferably with a knowledge of the subject.



Regulatory officials develop the guidelines for biotechnology research and the development of new products and processes. They work with company, government, or university researchers to review proposed research plans and assess the safety of resulting products. Regulatory officials must approve biotechnology research plans before they can be done and biotechnology products before they can be marketed. Individuals involved with the regulation of biotechnology research and products generally work for a federal or state government agency.

Manufacturing Management

A myriad of career opportunities has opened up for those technical professionals who wish to escape the bench and move into operations. According to human resources consultants, the undergraduate-degreed professional who may encounter frustration in a Ph.D.-dominant research lab will find that there are unlimited opportunities for growth on the operations side of a biotech business.



Business

Mitch Mandell, an Arizona biotech business recruiter, describes what he calls the "hidden" job market in the biotech supplier category. "The growth in life sciences research has created a market of instrument and consumables suppliers that fill the huge demand for the tools that these scientists need to do their job. I've found that the most difficult-to-find employees are the technical professionals with an interest in business, perhaps sales or marketing. These people are always in demand."



Sales and Marketing

Sales people work with the dealers and distributors of biotechnology products. They have expertise in marketing skills and are knowledgeable about the products.

One of the best places to excel with an undergraduate education in the life sciences remains the sales and marketing career. Good opportunities abound, in either the healthcare market for new biotech products, or in the supplier marketplace. Sales positions are tough competitive jobs that demand long hours and travel, but they can be very personally rewarding. Marketing positions generally require a minimum of some sales and business experience.



Business Development and Licensing

With the number of "deals" that are done in our industry, it is no wonder that Business Development and licensing positions continue to be hot. Universities, at competitive packages to industry, also recruit licensing executives heavily. Licensing is a critical connection between industry and academia, and will remain a hot career choice.

Intellectual Property

Patent lawyers who specialize in biotechnology help scientists, companies, or universities protect their legal rights to new discoveries. They file patent applications for their clients and interact with the U.S. Patent Office.

Many recruiting firms have found that the demand continues to be very strong for those life scientists who have gone on for either a law degree or for their Patent and Trademark Office registration. Having a legal degree without a science background does not provide entry to this private club, and with as many intellectual property issues that exist right now in both foreign and U.S. registrations, this will no doubt hold true for the future.

TOPICS OF GREATEST INTEREST THESE DAYS

Health enhanced Food

With increase in food related disorders and increased awareness, a new age of feed has begun where cholesterol-reducing margarine and eggs infused with heart-healthy fatty acids have arrived in a new category called "functional foods." There are also corn puffs and snack bars containing Ginkgo biloba, an herb thought to boost memory, and vitamin-dusted gummy bears. Researchers are trying to turn junk food into something masquerading as health food. Functional foods are broadly defined as those that claim, or at least hint broadly at, enhanced health benefits. Included are juice drinks fortified with herbs such as Echinacea, said to augment immunity (called as immunostimulant), and ginseng, believed to boost energy.

Foods that carry specific health assurances, such as disease prevention, are a different matter, requiring testing and approval from the U.S. Food and Drug Administration (FDA). Quaker Oats, with its claim that it can lower risk of heart disease, was the first functional food to get the green light. Now nearly a dozen such claims have been approved. Some foods, with drug-like qualities, are dubbed "pharmafoods" or "neutraceuticals" They include Benecol, the margarine claiming to lower cholesterol. This field is very promising in future.



Biochip or Biosensor

The development of biochips is a major thrust of the rapidly growing biotechnology industry, which encompasses a very diverse range of research efforts including genomics, proteomics, computational biology, and pharmaceuticals, among other activities. Advances in these areas are giving scientists new methods for unraveling the complex biochemical processes occurring inside cells, with the larger goal of understanding and treating human diseases. At the same time, the semiconductor industry has been steadily perfecting the science of microminiaturization. The merging of these two fields in recent years has enabled biotechnologists to begin packing their traditionally bulky sensing tools into smaller and smaller spaces, onto so-called biochips. These chips are essentially miniaturized laboratories that can perform hundreds or thousands of simultaneous biochemical reactions. Biochips enable researchers to quickly screen large numbers of biological analytes for a variety of purposes like, Disease diagnosis.



Today, a large variety of biochip technologies are either in development or being commercialized. Numerous advancements continue to be made in sensing research that enables new platforms to be developed for new applications. Cancer diagnosis through DNA typing is just one market opportunity. A variety of industries currently desire the ability to simultaneously screen for a wide range of chemical and biological agents, with purposes ranging from testing public water systems for disease agents to screening airline cargo for explosives.

Pharmaceutical companies wish to combinatorially screen drug candidates against target enzymes. To achieve these ends, DNA, RNA, proteins, and even living cells are being employed as sensing mediators on biochips. Numerous transduction methods can be employed including surface plasmon resonance, fluorescence, and chemiluminescence. The particular sensing and transduction techniques chosen depend on factors such as price, sensitivity, and reusability.

Nanobiotechnology

Nanotechnology is the creation and utilization of materials, devices, and systems through the control of matter on the nanometer-length scale (a nanometer is one billionth of a meter). Nanobiotechnology, an integration of physical sciences, molecular engineering, biology, chemistry and biotechnology holds considerable promise of advances in pharmaceuticals and healthcare. This report opens with an introduction to various techniques and materials that are relevant to nanobiotechnology. It includes some of the physical forms of energy such as nanolasers. Some of the technologies are scaling down such as microfluidics to nanofluidic biochips and others are constructions from bottom up.

Nanobiotechnology has several potential applications:

- Applications in life sciences
- Nanomolecular diagnostics
- Nanobiotechnology in drug discovery &development .
- Nanobiotechnology in drug delivery
- Clinical applications of nanobiotechnology

An increasing use of nanobiotechnology by the pharmaceutical and biotechnology industries is anticipated. Nanotechnology will be applied at all stages of drug development - from formulations for optimal delivery to diagnostic applications in clinical trials

Nanomedicine is now within the realm of reality starting with nanodiagnostics and drug delivery facilitated by nanobiotechnology. Miniature devices such as nanorobots could carry out integrated diagnosis and therapy by refined and minimally invasive procedures, nanosurgery, as an alternative to crude surgery. Nanotechnology will markedly improve the implants and tissue engineering approaches as well.

There is some concern about the safety of nanoparticles introduced in the human body and released into the environment. Research is underway to address these issues.

Stem cell research:

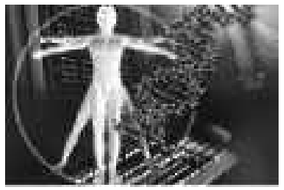
Stem cells are cells with capacity of dividing for infinite periods of time to give rise to specialized cells. Adult stem cells may be retrieved from some adult tissue (e.g. blood cells, nervous system cells). Scientists are interested in stem cell research for several reasons.

Firstly, it would help in understanding the events that occur during development. They need to understand more completely how cellular decisions are made to direct the specialization of cells. This could also shed light on how diseases like cancer occur and how to cure them.

Secondly, pluripotent stem cells could provide materials for the initial trial of new drugs in more cell types prior to clinical trials.

Thirdly, pluripotent stem cells could be manipulated to develop into specialized cells needed to replace specific damaged cells and tissues, there by reducing the cost of organ or tissue transplant. Pluripotent stem cells can be renewable source of replacement cells.

Although, stem cells research is becoming a socio-ethical issue these days. But the field has a great future and application ahead and will involve a lot of manpower in coming years.



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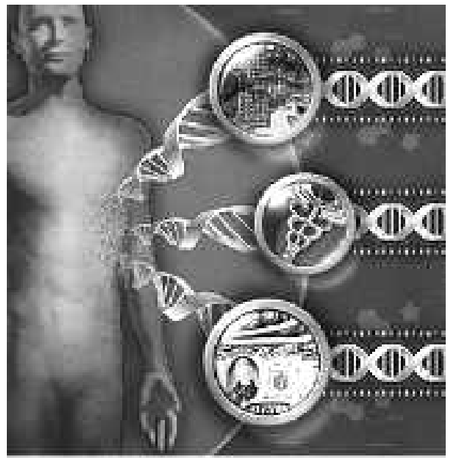


Human genome project (HGP):

HGP is a massive, government subsidized effort designed to sequence the entire DNA of a human so as to decipher the so-called "book of life". It involves multinational research team and private sector. It is the largest biological project ever taken and present many challenging technical problems. It will take thousands of person-hours to complete the entire sequencing. This task was tackled at 4 levels: construction of genetic (linkage) maps, construction of physical map, sequencing the genome, and comparative genomics

The detailed map of the human genome will provide several aids:
- Identifying and cloning genes
- Arranging sequenced segments
- Obtaining genetic markers, suitably placed throughout the genome . Obtaining detailed restriction maps
- Identification of genes involved in genetic disorders
- Their cure and advanced medical care

The successful completion will make a tremendous difference in medical diagnosis and care. This project will certainly aid all aspects of research.



CAREER OPTIONS

As there is increasing popularity and explosive growth, there is plenty of opportunities available in Biotechnology field. The nature of work of biotechnologists, being interdisciplinary, requires working together of people from different fields such as biology, chemistry, biochemistry, microbiology, molecular biology, immunology, genetics, engineering, food science, agriculture etc. Some of the fields where biotechnology studies are applicable are as follows.

1. Research associate: If you are interested in Research and Development, then becoming a Research Associate can provide an interesting career that allows you to carry out experiments under the instruction of established Scientists.

2. Research scientist: if you wish to enter the field at a high level, you may choose to become a Research Scientist. This involves working alongside established scientists to design and carry out experiments, then writing reports for future publication. This is the field of hard-core research.

3. Teacher or lecturer: this is one of the best ways of interacting with people and sharing your knowledge. It broadens yours knowledge spectrum and communication skills.

4. Engineer (Chemical, Electrical, Environmental and Industrial): This position would involve engaging in a range of projects from building robots and biochips to assisting with Research and Development.

5. Bioinformists: Structural biology, computational chemistry, mathematics and a love of computing are the combined traits of a Bioinformatics professional. The job comprises of data interpretation, sequencing, modeling of complex structures or processes etc.

6. Sales representative: As a sales representative, you would work with hospitals, doctors and a wide range of medical institutions to keep them aware of biotechnology's latest offerings, as well as trying to encourage their approval for your products over rival products in the market.

7. Marketing: In biotechnology marketing, you would manage and devise campaigns aimed at particular customer areas, through such methods as working with advertising agencies and maintaining a visible presence at medical conventions and trade shows.

8. Business development manager: This position involves working with colleagues to introduce products and to negotiate agreements with strategic partners.

9. Quality Control Officer or Production in-charge: these personals are specially required in the Food, Chemical and Pharmaceutical industry. They look upon the quality and production of products up to the optimal level.

10. Science Writer or editor: this involves an expert hand on writing, comprehension, editing etc plus an updated knowledge of biotechnological advancements, which are integral part of a journal or magazine.

11. Environmental Safety Specialist: the work involves inspection, report making & data interpretation of the organizations or industries, which are causing any kind of hazard to the environment. They also suggest alternative pathways to the organization.

12. Forensics: several highly publicized legal proceedings have featured the use of DNA fingerprinting. This technique is a specific application in RFLP analysis. The stastical analysis afterwards is complex and is based on its own set of assumptions - assumptions that are nearly impossible for non - experts to recognize.

13. Lab technician: includes cleaning and maintaining equipment used by scientists and working on the various pieces of lab equipment as instructed.

14. Support staff Administrator: there are different levels of staff and admistrative head required in a biotech company, depending on the size and complexity of operation. However personal along with biotechnological knowledge should be trained in administration, accounting, marketing, stastical, analytical and other support system disciplines.

CURRENT STATUS

Currently most of the countries are working on research and development (R&D) fields in biotechnology, in the following activities:

- Embryo transfer in animals
- Early diagnosis using monoclonal antibodies . Applied microbiology
- Renewable energy production e.g. Biogas . Single cell protein
- Enzymes and antibiotics
- Plant growth inhibitors

Natural products

- Bioinsectisides or biofertilisers
- Cloning
- Protein solvent concentration
- Bioreactors or bioprocessing
- Gene isolation
- Biological nitrogen fixation.
- Food additives
- Immunostimulants
- Health enhanced food or functional food . Biosensors
- Environmental protection
- Stem cell research

The industrial sector, however, highlights its interest in environmental engineering, process engineering in industries and its improvements, and other areas. This results from their sense of the importance of industrial production over the academic research, which may not result in any direct products or goods.

CONSTRAINTS

A recent survey on constraints to the applications of biotechnology has found these issues, mostly, in developing country:

- lack of financing is the most important restriction in universities and institutions in the private sector.

Although financial support is a serious problem, researchers (15 percent) cited other problems such as the shortage of professional technicians trained on advanced and specialized scientific equipment. Also of concern is the approvals procedure for biotechnological research, especially the long time between presenting the proposal and its implementation. The result is decreased interest of the researcher, who will often pursue other areas of research.

Another problem facing researchers in this area is the lack of consumable materials and routine ordering procedures. It is important to mention that the right scientific atmosphere is often absent for this type of research activity; the importance of this type of research is not made clear; it is expensive; it does not directly produce goods for people; and there is a lack of scientific literature and other materials. This lack of public awareness of the importance of biotechnology research and the absence of scientific groups who will provide the necessary cooperation and technical assistance to the researcher were cited by 30 percent in the survey.

University professors claim they do not have enough time to do their research, and the system itself does not allow the appointment of research staff. Professors in the universities should teach and do research at the same time, but because of the heavy teaching load, they cannot find enough time for research. The research would be of an academic nature and not applied research.

The industrial sector in this field is unable to compete with other international brand products, especially at the beginning of the production and development processes. This results in reduced financial support. As a result, the industry prefers not to be involved in this activity, which requires that most of the products be manufactured locally. The private sector, therefore, concentrates on accumulating imported products and promoting them locally, or dealing in international products only.

There is an additional problem regarding lack of cooperation among institutions in the same field to reach common objectives and solve problems. There are many drug companies, for example, but there is no common interest in biotechnological R&D.

There is a prevalent lack of knowledge in both private and governmental sectors about the importance of biotechnology adoption, and what is necessary to facilitate and expedite work in this field.

Last but not the least, fresher evolving are not exposed to industry and R&D.

CONCLUSION

Biotechnology as a subject has grown rapidly. And as far as employment is concerned, it has become one of the fast growing sectors. Employment record shows that biotechnology has a great scope in future. Some major organizations employing bio-technologists in India include Hindustan Lever Ltd, Thapar Group, Indo-American Hybrid seeds, Biocon India Ltd, Bivcol, IDPL, India Vaccines Corporation, Hindustan Antibiotics, National Botanical Institute, National Chemical Laboratories, Tata Engineering Research Institute etc.

Although biotechnology employment is still on the upswing, there are forces at work that put more people than ever into the market at this time. Whether it be layoffs from the mid-sized biotech companies who have had problems with their clinical results, or the downsizing pharmaceutical companies, there is much competition out there. Career experts advise to be prepared for a longer search than you expect, and not to anticipate several offers to choose from when the interviewing is over. If you are out there in the job market and experiencing frustration, don't be concerned by the optimistic tone of this article. There are others who are in a similar position, as the current job market for biotechnology can best be described as on a "roller coaster." Although a particular niche or discipline may go through this cycle, there is certainly a lot of light at the end of the tunnel. Looking at the industry through a long-range lens is critical when faced with a short-term problem like a lousy job market. Remuneration very much depends upon academic qualification, institute or university from which the degree is attained, determination and the level of work experience. So "survival of the fittest" always rules. But at the end of the day, every one who is concerned about his career should get his or her niche.



"Communicating well with children and young people is a real talent and a key part of the success that challenges young minds and unlocks potential."

Alan Johnston
UK Secretary of State for Education and Skills

Scope of Microbiology: Past, Present and Future

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Microbiology is the field of science, which deals with the structure, function and uses of microorganisms, such as viruses, bacteria, fungi, algae, protozoa and helminthes. Microorganisms are present everywhere on earth, including humans, animals, plants, soil, water, and atmosphere. Microorganisms are relevant to all of us in many aspects as the microorganisms are useful as well as harmful for the human life. For example, microorganisms are required for the production of bread, cheese, yogurt, alcohol, wine, beer, antibiotics, vaccines, vitamins, enzymes and many more important products and they are also the causative agents of many diseases. Microbiology is the largest and most complex of all the biological sciences dealing with diverse biological disciplines. It deals with every aspect of microbe-human-environmental interaction. Among these some are: ecology, genetics, metabolism, chemotherapy, immunology, genetic engineering, industry, and agriculture.

Microorganisms can be utilized as an important tool for exploring fundamental life processes and following features make them an attractive agent for the study or research purposes-

1- Microorganisms can be cultured easily as they reproduce rapidly on artificial culture medium.
2- The growth of microorganisms can be manipulated very easily by physical and chemical procedures.
3- The cells of microorganisms can be broken apart or their contents can also be easily separated into fractions of various particle sizes.
Due to these characteristics microorganisms are used as research models for determining exactly how various life processes takes place in terms of specific reactions and the specific structures involved.

From time immemorial, mankind has made use of microorganisms and their biochemical activities even knowing their existence; despite their small size, microorganisms are of immense importance to man. Microbes cause diseases, are sources of various foods, medicines and dispose of our wastes. The air we breathe comes from microorganisms as the free molecular oxygen was completely absent from the pre-biotic atmosphere and this gas has accumulated only as a byproduct of metabolism of primeval photosynthetic bacteria.

A specialized branch of microbiology known as, Industrial microbiology is mainly associated with the commercial exploitation of microorganisms and involves processes and products that are of major economic, environmental and social importance throughout the world. Roughly 14,000 tons of penicillin, 300 million tons of the flavour enhancer MSG(monosodium glutamate) and 1450 million tons of vinegar is being manufactured per annum using microbes by microbiologists. There are two major aspects of industrial microbiology: The first related to the production of valuable microbial products through fermentation processes. These include traditional fermented foods and beverages, such as bread, beer, cheese and wine, which have been produced for thousands of years. In addition over the last as many as hundred of years or so, microorganisms have been further employed in the production of numerous chemical feed stocks, energy sources, enzymes, food ingredients and pharmaceuticals. The second aspect is the role of microorganisms in providing services, particularly for waste treatment and pollution control, which utilizes their abilities to degrade virtually all natural and man made products and the process is known as biodegradation. Through the contribution of genetic engineering (in vitro recombinant DNA technology) many traditional and industrial fermentation processes are established. This technology has also facilitated the development of many novel processes and products, it not only accelerates strain development; leading to improvements in the production microorganisms, but can aid downstream processing and other elements of the process. Formerly, it is involved in the manipulation of bacteria, but now has moved to cloning yeasts, filamentous fungi, plant and animal cells. Many microbiological reactions are used in sewage treatment, in transforming the chemical structure of drugs, in cleaning clothes where bacterial enzymes used in biological detergents and even to extract metals like copper and uranium from their mineral ores.

Microorganisms can also be utilized as specific agents for large scale chemical transformations and that the microbial world as a whole might well be responsible for a wide variety of other geochemical changes and this branch of microbiology is known as Geomicrobiology. Many groups of microbes with a wide range of physiological diversity are specialized to bring about chemical transformations and play a vital role in the turn over of matter on the earth. Microorganisms are now being used in production of mammalian proteins such as insulin and human growth factors, in making vaccines from microbial and viral genes, in the production of new strains of microbes and also in the production of genetically modified organisms. This aspect of microbiology is used in recombinant DNA technology or in biotechonology. Many proteins of pharmacological importance can be produced by genetically engineered microorganisms. Vaccines and diagnostic kits also depend upon the use of improved strains of microorganisms. Human growth hormones have been cloned in bacteria, which can provide these things in sufficient quantities required for clinical trials and this branch of microbiology is known as clinical microbiology. The production of viral, bacterial, and protozoan antigens for protecting human against dysentery, typhoid, cholera etc. have been outlined and viral vaccines against flu or influenza, chickenpox and human immuno deficiency are found to be cloned successfully by the use of microorganisms.

Microorganisms play a key role in food microbiology as microbes are being used as flavoring agents in candy, ice-cream, fruit juices and other confectionaries, as a preservative for stored blood, in ointments and in cosmetics. Some vitamins such as vitamin B-12 and Riboflavin are also produced microbiologically, which is nowadays gaining importance world wide. Microbes play an important role in recycling of biological elements such as oxygen, nitrogen, sulfur and phosphorus, the processes is known as biogeochemical cycling. Microbes also play an important role in waste decomposition, some actinomycetes are in habitant of lake mud, but in general actinomycetes do not seem to be responsible for the earthy odor noticeable after ploughing. Biological sewage treatment and self purification are the common practices of microorganisms, both results in the mineralization of organic pollutants and in the utilization of dissolved oxygen. Complex microbial associations play an important role in self purification; and these communities dominate the ecology of treatment plants. Some of the organic molecules present in industrial effluents are readily decomposed by a variety of microorganisms; this use of microbes to reduce or degrade pollutants, industrial waste and house hold garbage is a new area referred to as bioremediation and is being given substantial importance now-a-days. A major aspect of it is the degradation or elimination of xenobiotic compounds with in industrial waste streams and the necessary bioremediation of contaminated land or bodies of water. Probably the most important role of microbes is in the treatment of solid and liquid wastes from domestic, municipal, agricultural and industrial sources, in order to reduce their potential environmental impact and to decrease the pollution content. This technology also reduces our reliance on synthetic chemical pesticides by allowing the implementation of biological control measures using bio insecticides, bio fungicides, bio fertilizers, so that the health and environment both can be improved.

Microorganisms can also be utilized in organic composting, increasing soil fertility, reclamation of alkaline user land and use of bio fertilizers and microbial pesticides in agriculture are some of the important areas in which different groups of microorganisms participate to a great extent. Agricultural microbiology is concerned with the impact of microorganisms on agriculture that is why agricultural microbiologists try to combat plant diseases that attack important food crops, work on the methods to increase soil fertility and crop yields and also in studying the role of microorganisms living in the digestive tracts of ruminants such as cattle. Currently there is great interest in using bacterial and viral insect pathogens as substitutes for chemical pesticides so that the degradation of soil as well as environment can be avoided.

A widely growing field of microbiology known as, Microbial Ecology is concerned with the relationships between microorganisms and the components of their living and non-living habitats. Microbial ecologists study the global and local contributions of microorganisms to the carbon, nitrogen and sulfur cycles. The study of pollution effects on microorganisms also is important because of the impact these organisms have on the environment, microbial ecologists are employing microorganisms in bioremediation to reduce pollution. Scientists working in food and dairy microbiology try to, prevent microbial spoilage of food and the transmission of food borne diseases. They are also using microorganisms for making foods such as cheeses, yogurts, pickles and beer. In the future, microorganisms themselves may become a more important nutrient source for live stock and humans.

Summarizing this, the importance of microorganisms can not be overemphasized in terms of sheer number and mass, as it is estimated that microbes contain 50°10 of the biological carbon and 90°10 biological nitrogen on Earth and they greatly exceed other group of organisms on the planet. Furthermore they are found every where i.e. from geothermal vents in the ocean depths to the coldest arctic ice to every persons skin. Microorganisms are the major contributors to the functioning of the biosphere, being indispensable for the cycling of the elements essential for life as these also are a source of nutrients at the base of all ecological food chains and webs. Most importantly, certain microorganisms carry out photosynthesis, rivaling plants in their role of capturing carbon dioxide and releasing oxygen into the atmosphere. The microorganisms which inhabit humans also play important roles, including helping the body in digesting food and producing vitamins B and K. In addition, society in general is benefited from microorganisms, as they are necessary for the production of bread, cheese, beer, antibiotics, vaccines, vitamins, enzymes, and many other important products. Indeed, modern biotechnology rests upon a microbiological foundation as microbes play an important role in each and every sphere of life or in other words we can say that without microorganisms life is impossible.

Fitness At Forty

Bodies change for the worse after the age of forty; although this does not happen overnight. Actually it starts right when we are in our twenties and grows on day by day. After the age of thirty start looking muscle mass and after forty the bone declines and every year. We gain about two pounds of fat weight Here are some tips by which you can show the again process.

Awareness around- Get attuned with the physical ranges in your body. especially those caused by your hormones. Women should keep touch with their gynaecologist and be aware of pre menopausal changes one should have a bone density test at least once a year to keep check on osteoporosis.

Increase vegetable and fruit intake- This will immensely help you to reduce your waist size. It can also alter your blood lipid profile by lowering your cholesterol level. Eating plenty of raw vegetables and fresh fruits will get rid of constipation and maintain your blood glucose level.

Short term exercises- Start with exercising at least half an hour three times a week and gradually it by five minutes every week. Choose an activity which suits you and make it a habit.. We never make an effort to throw of this stress. We should actually wind it day and don't let it accumulate or else it will prone harmful some day.

Health check up- A complete health check up. atleast once a year is essential. This will give you clear indication of the changes going in your body. Thus any unnatural changes can be identified and corrected at the grass root level.

Is Hackle's rule also applicable in biotechnology?

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YES? Hackle's rule is really applicable in biotechnology. As it is aware to all the biogenetic law of Haeckel i.e. Ontogeny repeats phylogeny which means developmental stages of an organism repeats evolutionary stages of its ancestor.

By the reference of this rule biotechnology is not new in the field of science. It exists from the very beginning .Presently the establishment of new biotechnology is the repetition of the old time biotechnology with new techniques for the production of better product, there is only advancement of ancient time biotechnology into the advance time biotechnology according to the evolutionary changes in the lifestyle from past time to the present time . Certain practices that we would now classify as applications of biotechnology have been in use since man's earliest days. Nearly 10,000 years ago, our ancestors were producing wine, beer, and bread by using fermentation, a natural process in which the biological activity of one-celled organisms plays a critical role. But our ancestors also found that by manipulating the conditions under which the fermentation took place they could improve both the quality and the yield of the ingredients themselves.

Crop Improvement

When early men went through the crucial transition from nomadic hunter to settled farmer, cultivated crops became important for survival. These primitive farmers, although ignorant of the natural principles at work, found that they could increase the yield and improve the taste of crops by selecting seeds from particularly desirable plants. Farmers long ago noted that they could improve each succeeding year's harvest by using seed from only the best plants of the current crop.. Through several years of careful seed selection, farmers could maintain and strengthen such desirable traits.

The possibilities for improving plants expanded as a result of Gregor Mendel's investigations in the mid-1860s of hereditary traits in peas. Once the genetic basis of heredity was understood, the benefits of cross-breeding, or hybridization, became apparent.But biotechnology has also revolutionized research activities in the area of agriculture now which includes the following:

(i) plant cell, tissue and organ Culture
(ii) genetic engineering leading to transformation followed by regeneration of plants to give transgenic plants carrying desirable, traits like disease resistance, insect resistance and herbicide resistance; eventually this may also be used for increasing photosynthetic efficiency, nitrogen fixing ability, improved storage proteins, hybrid crops, crops for food processing etc.

(iii) somatic hybrids between sexually incompatible species, Permitting transfer of desirable traits from wild or unrelated crop species to ,our crop plants

(iv) transgenic animals produced in mice, pigs, goats, chicken, cows, etc; it is suggested that some of these will eventually be used as bioreactors to produce drugs through their milk, blood or urine this area has sometimes been described as molecular farming

An understanding of the scientific principles behind fermentation and crop improvement practices has come only in the last hundred years. But the early, crude techniques, even without the benefit of sophisticated laboratories and automated equipment, were a true practice of biotechnology guiding natural processes to improve man's physical and economic well being.

Harnessing Microbes for Health

The late eighteenth century and the beginning of the nineteenth century saw the advent of vaccinations, crop rotation involving leguminous crops, and animal drawn machinery. The end of the nineteenth century was a milestone

of biology. Microorganisms were discovered, Mendel's work on genetics was accomplished, and institutes for investigating fermentation and other microbial processes were established by Koch, Pasteur, and Lister.

The origin of biotechnology can be traced back to prehistoric times, when microorganisms were already used for processes like fermentation. Although a molecular biologist may consider cloning of DNA to be the most important event in the history of biotechnology, the latter has actually been rediscovered in 1970's for the third time during the present century.

In 1920's Clostridium acetobutylicum was used by Chaim Weizmann for converting starch into butanol and acetone; the latter was an essential component of explosives during World War I. This raised hopes for commercial production of useful chemicals through biological processes, and may be considered as the first rediscovery of biotechnology in the present century.

During World War II (in 1940's), the production of penicillin (as an antibiotic discovered by Alexander Fleming in 1929) on a large scale from cultures of Pencillium notatum, marked the second rediscovery of biotechnology. This was the beginning of an era of antibiotic research.

The third rediscovery of biotechnology is its recent reincarnation in the form of recombinant - DNA technology, which led to the development of a variety of gene technologies and is thus considered to be the greatest scientific evolution of this century. Thus, even though biotechnology had its origin 10 the past, it has assumed special significance only in 1970's and 1980's

Bioiotechnology in the present era

Biotechnology seems to be leading a sudden new biological revolution. It has brought us to the brink of a world of "engineered" products that are based in the natural world rather than on chemical and industrial processes. Biotechnology at the beginning of the twentieth century began to bring industry and agriculture together.

Biotechnology has been described as "Janus-faced." This implies that there are two sides. On one side, techniques allow DNA to be manipulated to move genes from one organism to another. On the other, it involves relatively new technologies whose consequences are untested and should be met with caution. The term "biotechnology" was coined in 1919 by Karl Ereky, an Hungarian engineer. At that time, the term meant all the lines of work by which products are produced from raw materials with the aid of living organisms. Ereky envisioned a biochemical age similar to the stone and iron ages. Biotechnology is currently being used in many areas -Gene Technology As a Tool for Biotechnology-gene technology has become a major thrust area of present day researches Hybridoma Hybridoma and Monclonal Antibodies in Biotechnology - Hybridoma technique and monoclonal antibodies is another very important area in which rapid progress has been made, so that it is being extensively utilized for human health care, and a variety of other purposes Tissue Culture Techniques in Biotechnology-. An important aspect of all biotechnology processes is the culture of either the microorganisms or plant and animal cells (or protoplasts in case of plants) or tissues and organs in artificial media. These possibilities led to significant advances and novel possibilities. While microbes in culture are used in recombinant DNA technology and in a variety of industrial processes, plant cells and tissues are used for a variety of genetic manipulations.

For example, anther culture is used for haploid breeding; gametic and somatic cell tissue cultures are used for tapping gametoclonal and somaclonal variation or for production of artificial seeds. Transformation of protoplasts in culture leads to the production of useful transgenic plants. Embryo culture technique has also helped in extending the range of distant hybridization for plant breeding purposes. Similarly animal cells (e.g. egg cells) are used for multiplication of superior livestock using a variety of techniques like cloning of superior embryonic cells, transformation of cultured cells leading to the production of transgenic animals, and in vitro fertilization and transfer of embryos to surrogate mothers.Biotechnology in Medicine - In the field of medicine, insulin and interferon synthesized by bacteria have already been released for sale. A large number of vaccines for immunization against deadly diseases, DNA probes and monoclonal antibodies (including ELISA tests) for diagnosis of various diseases, and human growth hormone and other pharmaceutical drugs for treatment of diseases are being released or are in the process of being released.

In 1988, an experiment to introduce in human body, the lymphocytes containing a bacterial gene has been approved for patients who were in the terminal stages of cancer and had no chance to survive. During 1990-92, patients suffering with some lethal diseases were subjected to gene therapy.

These patients are doing well. DNA fingerprinting and autoantibody fingerprinting techniques are also proving a great boon in forensic medicine for identification of criminals like murderers and rapists through the study of DNA or antibodies from blood and semen stains, urine, tears, saliva, perspiration or hair roots, etc. Biotechnology and Protein OR Enzyme Engineering - Another very important area of biotechnology is protein engineering, that will lead to the production of superior enzymes and storage proteins. In this area, a protein engineer first prepares a computer aided protein model for a specific function and then prepares a synthetic gene that will produce this desired protein in a predictable manner.

Thus, in future, proteins will be engineered in the desired manner. Biotechnology has also provided us with a remarkable technique in the form of immobilized enzyme systems, which allowed the production of a variety of substances e.g. production of high fructose corn syrup (as a sweetening agent for soft drink industry) using an immobilized enzyme, glucose isomerase.

The market for these immobilized enzymes now is of the order of billions of dollars per year and supports multibillion dollar industries, because the cost involved in the production of these enzyme systems is only a fraction of the value of the products manufactured.

Biotechnology & Industrial Microbiology - Industrial microbiology is yet another area, receiving major attention biotechnologists. A number of pharmaceutical drugs and chemicals are being produced, or will be produced in future utilizing techniques of biotechnology (including genetic engineering) to increase substantially bon the quality and the quantity of these drugs and chemicals.

Biotechnological methods have been devised for some environmental problems like the following:
(i)pollution control,
(ii)depletion of natural resources for non-renewable energy,
(iii) restoration of degraded lands and
(iv) biodiversity conservation. For instance, microbes are being developed to be used as biopesticides, biofertilizers, biosensors, etc., and for recovery of metals, cleaning of spilled oils and for a variety of other, purposes.
They are also used for biomonitoring in industries, where I employees are exposed to a variety of risks. Biomass is being produced and used as a renewable source of energy, by capturing solar energy.

Tissue culture and genetic engineering, mycorrhizae (VAM fungi), root nodulation (both in legume and non-legumes, using bacteria like rhizobia and actinomycetes fungus like Frankia) are also being used for reclamation of degraded lands.

Biotechnology & Environment - Biotechnology is also being used for dealing with environmental problems Fears are also being expressed about the implication of advances in biotechnology in terms of release of harmful organisms developed through recombinant DNA technology. In view of this, rules and laws have been framed from time to time to safeguard against the risks, which the recombinant DNA technology poses to the clean and friendly environment. Biotechnology and Metabolic Engineering - One of the major objectives of biotechnology research is the use of living systems for the production of metabolites at the industrial scale. However, cell's metabolic networks that evolved in nature are not optimized for industrial production of these metabolites.In such cases, performance of metabolic pathways is being manipulated, so that the metabolites are overproduced.The opportunity to introduce heterologous genes and regulatory elements made 'metabolic engineering',

a very fascinating area of research.However, there is a variety of limitations in metabolic engineering that need to be overcome.

For instance, when alterations are made (by genetic manipulations) for flux distributions at key branch points (called nodes) of a metabolic pathway, this may be opposed by mechanisms evolved in the cell for its optimal; growth. This is described as 'network rigidity' and efforts are being made to overcome problems.

A common misconception among teachers is the thought that biotechnology includes only DNA and genetic engineering. To keep students abreast of current knowledge, teachers sometimes have emphasized the techniques of DNA science as the "end-and-all" of biotechnology. This trend has also led to a misunderstanding in the general population. Biotechnology is NOT new. Man has been manipulating living things to solve problems and improve his way of life for millennia. Early agriculture concentrated on producing food. Plants and animals were selectively bred, and microorganisms were used to make food items such as beverages, cheese, and bread.

Biotechnology is currently being used in many areas including agriculture, bioremediation, food processing, and energy production. DNA fingerprinting is becoming a common practice in forensics. Similar techniques were used recently to identify the bones of the last Czar of Russia and several members of his family. Production of insulin and other medicines is accomplished through cloning of vectors that now carry the chosen gene. Immunoassays are used not only in medicine for drug level and pregnancy testing, but also by farmers to aid in detection of unsafe levels of pesticides, herbicides, and toxins on crops and in animal products. These assays also provide rapid field tests for industrial chemicals in ground water, sediment, and soil. In agriculture, genetic engineering is being used to produce plants that are resistant to insects, weeds, and plant diseases

A current agricultural controversy involves the tomato. A recent article in the New Yorker magazine compared the discovery of the edible tomato that came about by early biotechnology with the new "Flavr-Savr" tomato brought about through modern techniques.

What will you think as you raise the tomato to your mouth? Will you hesitate? This moment may be for you as it was for Robert Gibbon Johnson in 1820 on the steps of the courthouse in Salem, New Jersey. Prior to this moment, the tomato was widely believed to be poisonous. As a large crowd watched, Johnson consumed two tomatoes and changed forever the human-tomato relationship. Since that time, man has sought to produce the supermarket tomato with that "backyard flavor."

Throughout human history, we have learned a great deal about the different organisms that our ancestors used so effectively. The marked increase in our understanding of these organisms and their cell products gains us the ability to control the many functions of various cells and organisms. Using the techniques of gene splicing and recombinant DNA technology, we can now actually combine the genetic elements of two or more living cells. Functioning lengths of DNA can be taken from one organism and placed into the cells of another organism. As a result, for example, we can cause bacterial cells to produce human molecules. Cows can produce more milk for the same amount of feed. And we can synthesize therapeutic molecules that have never before existed.

New biotechnological techniques have permitted scientists to manipulate desired traits. Prior to the advancement of the methods of recombinant DNA, scientists were limited to the techniques of their time -- cross-pollination, selective breeding, pesticides, and herbicides .**Today's biotechnology has its "roots" in chemistry, physics, and biology. But the current scenario of biotechnology in the notion of student is very restricted they know this branch** as a simply changing the singular noun to its plural form.

Bacillus thuringiensis:
The biological weapon

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Introduction

Bacillus thuringiensis was first discovered in a diseased silkworm by the Japanese bacteriologist Ishiwata in 1901. It was not investigated until 1911 as a pathogen of flour moths from the province of Thuringia, Germany by a bacteriologist named Berliner. It was first used as a commercial insecticide in France in 1938, and then in the USA in the 1950s. However, these early products were replaced by more effective ones in the 1960s, when various highly pathogenic strains were discovered with particular activity against different types of insect.

Bt an insecticidal bacterium, marketed worldwide represent about 1% of the total 'agrochemical' market (fungicides, herbicides and insecticides) across the world for control of many important plant pests, is a live microorganism that kills certain insects and is used to kill unwanted insects in forests, agriculture, and urban areas. The commercial Bt products are powders containing a mixture of dried spores and toxin crystals. They are applied to leaves or other environments where the insect larvae feed. In their natural form, acute toxicity of commonly-used B.t. varieties is limited to mainly caterpillars of the Lepidoptera (butterflies and moths), beetle larvae and also for control of mosquito larvae, and simuliid blackflies that vector river blindness in Africa. Bt products represent about 1% of the total 'agrochemical' market (fungicides, herbicides and insecticides) across the world. The commercial Bt products are powders containing a mixture of dried spores and toxin crystals.

When the conditions for bacterial growth are not optimal *Bacillus thuringiensis*, like many other bacteria, forms spores. Spores are the dormant stage of the bacterial life cycle. Unlike many other bacteria, when Bacillus *thuringiensis* creates spores, it also creates protein crystals and they constitute the toxic component.

Bacillus family

B.t. is a species of bacteria that has insecticidal properties affecting a selective range of insect orders. There are at least 34 subspecies of B.t. (also called serotypes or varieties) and probably over 800 strain isolates. *Bacillus thuringiensis* products available in the United States are comprised of one of five varieties of B.t.; B.t. var. *kurstaki* and var. *morrisoni*, which cause disease in moth and butterfly caterpillars; B.t. var. *israelensis* which causes disease in mosquito and blackfly larvae; B.t. var. *aizawai* which causes disease in wax moth caterpillars; and B.t. var. *tenebrionis*, also called var. *san*

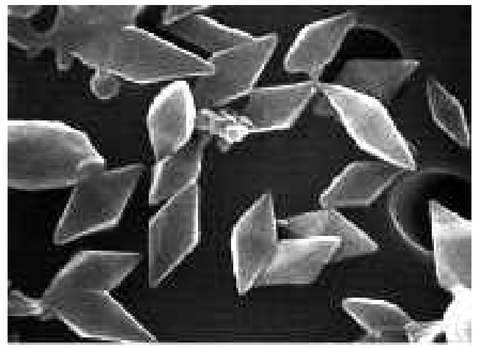


Figure: Bt toxin crystals

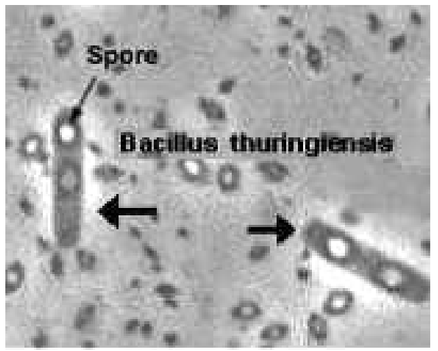


Figure: sporulation in Bacillus thuringiensis

diego, which causes disease in beetle larvae. Other strains of B.t. have been discovered that exhibit pesticidal activity against nematodes, mites, flatworms, and protozoa B.t. products are used to control moth pests in fruits, vegetables, and beehives; blackfly and mosquito pests in ponds and lakes; and several beetle pests in vegetables and shade trees. Common brand names include Dipel, Foray, Thuricide(all B.t. kurstaki), Vectobac, Mosquito Attack(all B.t. israelensis), and M-Trak (B.t. tenebrionis).

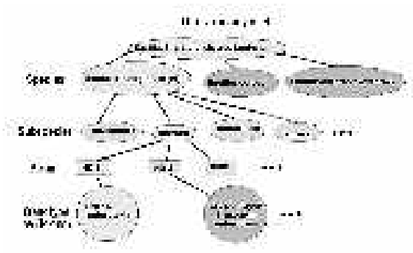


Figure: Bt classification

Bt toxin: classification & mechanism of action:

The *B. thuringiensis* "species family" of bacteria (which includes B. cereus and B. anthracis) are distinguished by their ability to produce several different substances that are either immediately toxic to some life forms or toxic when placed in the proper environment. *B. thuringiensis* strains produce two types of toxin. The main types are the Cry (crystal) toxins, encoded by different *cry* genes, and this is how different types of Bt are classified. The second types are the Cyt (cytolytic) toxins, which can augment the Cry toxins, enhancing the effectiveness of insect control. Over 50 of the genes that encode the Cry toxins have now been sequenced and enable the toxins to be assigned to more than 15 groups on the basis of sequence similarities. The table below gives the nomenclature for the three major types:

Classification of Bt Toxins			
Name	**Target Organism**	**Production**	**When toxic**
beta-exotoxin	toxic to many life forms	exuded by active bacteria	immediately
delta-endotoxin or protoxin	generally toxic to certain insects	crystalline protein formed on sporulation	requires alkaline environment to convert to toxin
B. cereus type enterotoxin	toxic to mammals - causes gastroenteritis	exuded by active bacteria	immediately

The toxin crystals are aggregates of a large protein (about 130-140 kDa) that is actually a protoxin - it must be activated before it has any effect. The crystal protein is highly insoluble in normal conditions, so it is entirely safe to humans, higher animals and most insects. However, it is solubilised in reducing conditions of high pH (above about pH 9.5) - the conditions commonly found in the mid-gut of lepidopteran larvae. For this reason, Bt is a highly specific insecticidal agent.

Once it has been solubilised in the insect gut, the protoxin is cleaved by a gut protease to produce an active toxin of about 60kD. This toxin is termed delta-endotoxin. It binds to the midgut epithelial cells, creating pores in the cell membranes and leading to equilibration of ions. As a result, the gut is rapidly immobilised, the epithelial cells lyse, the larva stops feeding, and the gut pH is lowered by equilibration with the blood pH. This lower pH enables the bacterial spores to germinate, and the bacterium can then invade the host, causing a lethal septicaemia.

When conditions for bacterial growth are not optimal B.t., like many bacteria, forms spores. Spores are the dormant stage of the bacterial life cycle, when the organism waits for better growing conditions. Unlike many other bacteria, when B.t. creates spores it also creates a protein crystal. This crystal is the toxic component of B.t.. After the insect ingests B.t., the crystal is dissolved in the insect's alkaline gut. Then the insect's digestive enzymes break down the crystal structure and activate B.t.'s insecticidal component, called the delta-endotoxin. The deltaendotoxin binds to the cells lining the midgut membrane and creates pores in the membrane, upsetting the gut's ion balance. The insect soon stops feeding and starves to death. If the insect is not susceptible to the direct action of the delta-endotoxin, death occurs after B.t. starts vegetative growth inside the insect's gut. The spore germinates after the gut membrane is broken; it then reproduces and makes more spores. This body-wide infection eventually kills the insect.

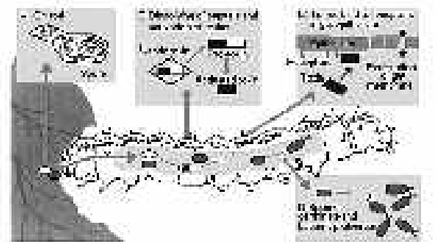


Figure: Mechanism of toxicity of Bt

Such resistance can develop quite rapidly when only one type of toxin is involved. In fact, it happened within 1 or 2 years when the mosquito-active Bt strains were widely used in tropical countries. The basis of resistance seems to be complex, involving several factors. But one encouraging finding is that, at least in some insects, the receptor for the Bt toxin is an essential gut enzyme, aminopeptidase-N, so any change in this receptor that causes a loss of binding to the toxin could also be detrimental to the insect, potentially reducing the fitness of the resistant insects.

Toxicity & its Limitations:



In a purified form, some of the proteins produced by B.t. are acutely toxic to mammals. However, each of the more than 800 strains of Bacillus thuringiensis may exhibit different toxicity to insects, rodents and humans. Many Bt bacteria also produce one or two other toxins. Both are secreted by the bacteria in its non-spore (growing) life stage. The beta-exotoxin is quite toxic to many life forms. In fact, any Bt that produces beta-exotoxin. Another toxin is B. cereus enterotoxin, so called because B. cereus produces much more of this toxin than most Bt strains. However, almost all Bt's produce some amount of this toxin, which causes gastroenteritis (food poisoning) in humans. This fact complicates any discussion about the toxicity of B.t. The following table shows the summary of the acute toxicity data available for two commonly used commercial varieties of B.t.

S. No.	commonly used commercial varieties of B.t.	Model organism	Mode of application	Observed toxicity symptoms
1.	Bacillus thuringiensis var. kurstaki B.t.k.	rat	intravenously	aggravated preexisting disease
		rat	oral	Acute toxicity
		rat	respired in air containing b.t.k. spores	respiratory depression;
		rabbit	injection	irritating to skin and eyes
2	Bacillus thuringiensis var. israelensis B.t.i.	mice	injected with a b.t.i. suspension	Spleens became enlarged
		mice	injection of both viable and inactivated b.t.i. spores under the skin	abscesses
		rabbit	injection	irritating to eyes
		mice	intravenously	rapid paralysis, followed by death within 12 hours

Plants genetically engineered with the Bt gene

Since 1996, a wide range of crop plants have been genetically engineered to contain the delta-endotoxin gene from Bacillus thuringiensis. These "Bt crops" are now available commercially. They include "Bt corn", "Bt potato", "Bt cotton" and "Bt soybean". Such plants have been genetically engineered to express part of the active Cry toxin in their tissues, so they kill insects that feed on the crops.

In some respects, this is an important technological and practical development, because it ensures that only those insects that attack the crop will be exposed to Bt toxins - there is no risk to other types of insect. It also ensures that the range of uses for Bt is extended to insects that feed on the roots or that bore into the plant tissues - for example, the European corn borer - because such insects cannot be controlled by Bt suspensions sprayed onto plant surfaces.

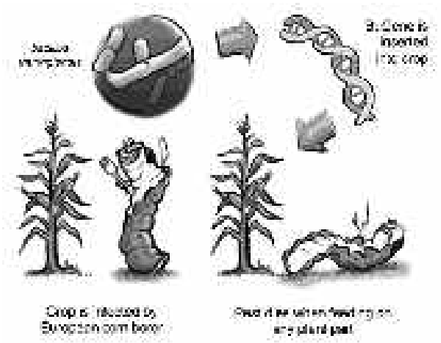


Figure: Plant genetically engineered with Bt gene

However, there is also a "downside", because the target insects are perpetually exposed to toxins and this creates a very strong selection pressure for the development of resistance to the toxins. Various crop-management strategies are being developed to try to minimize this risk.

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Back Pain & Diving

Sitting long hours in the car can make back pain worse

- What is the best diving position ?
- Ensure as much of your things are supported by the seat as possible
- Don't sit too far away from the pedals at this may put additional strain on the upper back & neck
- Adjust the stearing wheel so that you can reach it with bent aims hands in the 10-2 position

- If you have a lumbar support adjust it so it presses gently on the lower back at best height
- Emergency treatment of Acute Back Pain
- severe low back pain usually come on suddenly and caused by a minor movement such as bending over
- the pain may increases over a couple of hours as inflammation develops
- the pain is usually in the lumbal area of the spine but can radiate into the butlocks

1. Get into a position of least pain
 - supine
 - prone
 - side
2. Avoid movements or positions that make the pain work.
3. Bed rest
4. Taping the lower back can retiere pain. and give support as can use of a specialist back support belt or back brace.
5. NSAID'S
6. Electrotherapy- TENS.
7. Avoid sitting in the same position for long periods of time
8. Massage
9. Use of an inversion table to apply gentle traction may also help recieve symptoms.

Sanchita Pal, B.Sc. Micro IInd year

Points on Fitness and Training

Dr. Shagun Agarwal, Dept. of Physiotherapy, IAMR, Ghaziabad

The following are some general points on fitness and training for both the athlete and non-athlete:
Ref: Sports training principles by Dr. Shagun Agarwal. MPT MIAP (Sports Physiotherapist)

1. When beginning a programme of exercise one must work first on heart endurance then progress to other areas. However, before beginning any programme both athlete and non-athlete should have a check-up. Exercise will cause no harm unless perhaps there is a history of illness, in which case medical advice may be sought.
2. Children will not damage a healthy heart by exercising. When they are tired they stop.
3. Stiffness following exercise is not serious. Only a sharp pain during the next bout of exercise may be cause for alarm. This might be a slight muscle pull, and rest followed by jogging will return things to normal. If the pain persists a physiotherapist must be consulted.
4. There is no such thing as 'overtraining'. One may appear to lose quality in training, but that will be related to the effect of all one's various stressors. Rather than reduce training, evaluate the other areas in your life.
5. Too much training does not shorten life, but too little 'nay. It cannot be said that training will necessarily lengthen life, but it should help one enjoy one's 'allotted span'.
6. Women can train as hard as men following pregnancy; women have even recorded better performances in sport than those women who have not had children.
7. People do not 'go to fat' when they finish serious training. The fact is that their appetites often stay high while their energy expenditure is now low, and, consequently, weight increases. Also, muscle tone is lost and various areas begin to stag.
8. Training does not make a person muscle bound. This is an obscure expression, but presumably it refers to those who train for body building. Incredible physical dimensions only occur if athletes deliberately set out to hypertrophy the size of various muscles. Normal exercise programmes do not have this effect. In fact by reducing fat around the muscle, and improving muscle tone, a more attractive definition of the limbs with result.

Exercise machines are not necessary for the non-athlete, but may motivate him to train. Inexperienced users may risk injury and should choose machines with care. Isometrics should not be used indiscriminately, especially by 35 year olds and over. They may overload the heart.

"Learning is finding out what you already know. Doing is demonstrating that you know it. Teaching is reminding others that they know just as well as you. You are all learners, doers, teachers ..."

Richard Bach
American Author

Some important diseases in India

Dr. Poonam Singh

Hypertension

The prevalence of hypertension is reported to range h/w 20-40/ is urban areas. While it is between 12 to 17/in rural areas. The number of people hypertension is expected to see from 118.2 million in b000 to 213.5 million in 2025. Hypertension usually occurs in con-function other metabolically limited risk factor such as glucose intolerance obesity.

Cancer

The incident rate for cancer in men varies from 44 per 100,000 people in rural Maharastara to 121 per 100,000 in Delhi the major cause of career among men are mostly to bacco related lung, oral cavity, larynx, Desophagns +Phaeynx.

Q. What is diabetes ?

It is a chronic disease that occurs when the pancreas does not produce enough Insulin, or alternatively. When the body cannot effectively use the insulin produces. Insulin is a hormone that regulates blood sugar, Diabetes can damage the never and blood vessels .

Types Type 1 diabetes Types 2 diabetes

Type 1 diabetes: (also known as Insulin-dependent or childhood-) is characterized by a lack of Insulin production without daily fatal.

Symptoms: excessive excretion of urine
excessive thirst constant hunger
weight loss early fatigue

These symptom's may occur suddenly

Type 2 diabetes: (also called non insulin dependent adult-outset) results from the body's ineffective use of insulin. Type 2 diabetes comprise 90% of people with diabetes around the world and is largely the result of excess body weight physical inactivity. Symptours may be similar to these of Type 1 diabetes, but are often less in ached. As a result, the disease may be diagnosed several years after outset. Once comprevations have already ausen

Consequences of diabetes

HEART DISEASE

The estimated prevalence of coronary heart disease India is 8-10% in urban area among adults over 20, the prevalence in reveal areas in b/w 3-4%. There is 6 food rise is coronary heart disease in urban areas over past 4 decades.

STROKE

The prevalence of stroke is thought to be 203 per 100,000 among people older thaw 20. Although the prevalence of stroke appears to be comparatively less in India thaw developed countries but It is expected It will rise as India is going through developing.

I WISH I WERE

Can't act like Shahrukh, can't play like Sachin
But still in this life, I have to win, can't spug
Like Lata, can't design like Ritu
But still I believe, God has some thing for once too,
Can't work like kalam, can't think like Newton
But still I believe, will be full of fun.
can't explore like Kalpana, can't write like
Arundnati
But still I believe, I'm very justy.
So, I wish I were
Something or the other
Some times this sometimes that
Success is something, I'll surely get,
Hence whatever I'll be and wherever I'll be
There'd be no one like me.
No matter the struggler we have to fight
We must face everything with all our night
To reach those highest heights!

- Rahul Gaur, B.P.T. Final year

The Three stages of Examination

God is the greatest examiner
We all the students;
This life is an answer book
On which we have to give an examination
This world is the examination hall
Where we all are seated;
The time allowed is only three hours
first hour's bell rings in children;
Second is youth, and the third is old age.
The bell of the last hour,
Is the ring by the message of God.
The examination is over,
The answer book is snatched;
So life these meets an end
Write down What you Know
Before the third bell rings.
So that you may not have to say
The paper was length.
The time was short
If we happen to fail,
We have to come back to the same hall,
A new life once more.
If we pass,
We go to heaven and return no more

"It must be remembered tht the purose ofeducation is not to fill the minds of studentswith facts … it is to teach them to think,and always to think for themselves."

Robert Hutchins
American Educational Philosopher, (1899-1977)

Induction Programme of PGDM - 2008

IAMR organized a 5-day long Induction Programme for its third batch of PGDM (2008-10) during 9th July 2008 to 14th July 2008 at IAMR, Ghaziabad. The inauguration of the orientation program was held in the IAMR campus on 9th July 2008. The august occasion was graced by Ms. Anshu Bansal, Jt. Secretary, IAMR group of Institutions, Dr Pramila Tiwary, Director, PGDM, Dr. S.N. Laharia, Academic Director and faculty members.

Dr Tiwary formally welcomed the students and called upon them to work round the clock to gather maximum knowledge and improve upon their personality as well as communication skills to beat the global competition.

Ms. Anshu Bansal apprised the students of the vision and mission of the Institute and plans for providing the world class Institution to the students. She assured the students of excellent placements provided they equipped themselves with requisite skills during the next two years.



Dr. Laharia briefed the students about the PGDM curriculum, teaching methodology, assessment system and placement plans. He also emphasized the need of rounding up the rough edges of personality and sharpening of communication skills to ensure worth while placements. He also called upon the students to be punctual and well disciplined to gain maximum mileage from the course.

The inauguration was followed by a series of guest lectures from eminent speakers from corporate sector and academia who shared their views & experiences on various topics of importance to the Management students. There were in all 10 lectures during 5 days as follows:



Day	Session	Speaker	Topic
Day 1 - 9/7/08	1	Mr. H.S. Sharma Director, AMIT, Pilukhwa, Ghaziabad Have been director in Maharaja Agrasen Institute of Technology, Sunderdeep Engineering College, GIIT, Greater NOIDA and Professor in GGSIP University, Delhi	Importance of values of management & Self Realization
	2	Dr. Rishi Mehra Free Lancer, Corporate Partners, Senior Research Analyst, Jindal Group of Companies, Quasar India Ltd., Escorts Finance Ltd. Visiting Faculty, FMS, IMT, ICFAI, EMPI, JIMS, SRIM, BIFM, INFLUX and CMD	Money: The Blood of Economic System
Day 2 - 10/7/08	1	Dr. Saumya Krishna Investment Trainer, GENPACT, Gurgaon Visiting Faculty, IILM, Sri Ram Institute of Management, Delhi	Current Issues in Finance in Global Market
	2	Mr Vinay Gupta GM, NTPC, Noida	Time Management and its Importance
Day 3 - 11/7/08	1	Mr. M. Dutta Professor, IMT, Ghaziabad	Contemporary Issues in Finance
	2	Mr. Rajat Iyer CEO, Sarthak, Marketing Research and Advertising Firm, Lajpat Nagar, New Delhi	Communication Skills
Day 4 -12/7/08	1	Dr. Mirza Ex Professor, IIM Ahmedabad	Management Style of Managers
	2	Justice Karpaga Vinayagam	Winning Strategies in Management
Day 5- 14/7/08	1	Dr. S. Nigam	Mastering the Self Excellence
	2	Dr. Raina	Exact Science and Social Science

Science Exhibition & Guest Lectures

Mr. H.S. Sharma talked about Importance of Values in Management & Self Realization and apprised the students of setting realistic goals according to their capabilities. He discussed in detail about various spiritual ways of controlling the stress in this professional blind race.

Dr. Rishi Mehra delivered a lecture on the topic Money-The Blood of Economic System. He discussed the role and impact of money in the current economic system.

Dr. Saumya Krishna talked about the Current Issues in Finance in Global Market and Importance of Taking Risk in Business. She discussed about the distress of U.S economy.

Mr. Vinay Gupta apprised the students of Time Management and its Importance. He emphasized on importance of time distribution for the desired result.

Dr. M. Dutta delivered a talk on Contemporary Issues in Finance. He shared with the students about share market (BSE, NSE etc.) and various technical terms related to finance.

Mr. Rajat Iyer made the students acquainted with the essentials of becoming a good communicator. He emphasized on the importance of Communication Skills in the areas of Business and Management.

Dr. Mirza elucidated about Management style of Managers. He described about the need and impact of social and rational systems of organizations. He discussed that every organization starts with social system and reaches a rational system at its maturity.

Justice Karpaga Vinayakam conversed on Winning Strategies in Management. He shared that the first two steps of success are to decide a goal and to be devoted to the goal. He called upon the students to face the difficulties bravely and to be bold in adverse conditions also.



Dr. S. Nigam focused on Mastering the Self Excellence. He implored the students to open their mind and create innovative thoughts and works. He also asked the students to build positive attitude in actual working culture.

Dr. Raina discussed about Exact Science and Social Science. He apprised the students of the importance of Social Science for humans. He also discussed about the difference between professional and social aspects of managers.

The Induction Program exposed the students to a unique way of life, taking them out of the comfort zone to gain self-awareness of their weaknesses, and helping them to stretch their limits and move towards the goal.



Cultural Events



Cultural Events



Sports Events



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PGDM - Post Graduate Diploma in Management

The Program



The contents are well designed and structured by the eminent academicians, intellectuals, management experts, and industrial professionals keeping in line the present needs as well as future requirements. Our aim is that each student should have a strong theoretical background and command over managerial skills in all the pivotal areas.

During First Year, all the students are required to pursue essential core courses in different aspects of business management, while in the second year, primary focus is on developing specialization in any one or two selected areas viz Finance, Marketing, H.R, and I.T. We have also made provisions of dual specialization (as Major and Minor) to increase their job prospects.

Duration of Course

The course is for 2 years. Designed on semester system the medium instruction and examination would be English.

Eligibility

The minimum qualification for the PGDM is Bachelor's degree in any discipline (in 10+2+3 pattern) from any University in India or overseas recognized by the University Grants Commission (UGC). Candidates appearing/ appeared for the qualifying degree will also be considered for admission provisionally subject to their production of degree/ certificate by November.



Institute of Technology & Management

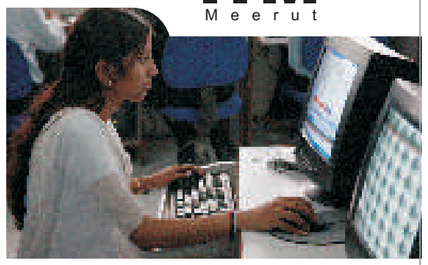
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ITM
Meerut

B.TECH (4 years degree course)

Computer Science & Engineering
Electronics & Communication Engineering
Mechanical Engineering
Information Technology
MBA





The Program

Engineering, much like science, is broad discipline which is often broken down into several sub-disciplines. This disciplines concern themselves with differing areas of engineering work. Although initially an engineer will be trained in a specific discipline, throughout his/her career the engineer may become multi-disciplined.

Eligibility

The eligibility for B.Tech programme is 10+2 with PCM. UPTU annually conducts an entrance examination (UPSEAT) and all the students are admitted on the basis of merit by the University.

Eligibility for MBA: Graduation in any stream.

Electronics Department

- Electronics Lab
- Analog Communication Lab
- F.C. Lab
- Digital Communication Lab
- Microprocessor Lab
- EMIM Lab (Measurement lab)
- Microwave & Optical Communication Lab
- Power electronics & Control Lab
- Network Lab
- Analog IC. Lab
- Digital IC. Lab
- PCB Lab
- DSP Lab
- Electrical Lab

Mechanical Engg. Labs

- Fluid Mechanics Lab
- Fluid Machinery Lab
- Mechanical Engg. Lab
- Material Science & Testing Lab
- Applied Thermodynamics Lab
- Mechanics of Machines Lab
- Refrigeration & Air Conditioning Lab
- Measurement & Metrology Lab
- Heat & Mass Transfer lab
- Manufacturing Science I Lab
- Machine Design I & II
- Workshop & Manufacturing Science II Lab
- Engg. Graphics Lab
- Automobile Engg. Lab
- Computer Aided Design Lab

CS / IT Lab

- Computer Organization Lab
- Numerical Technique Lab
- Information System Lab
- Computer Graphics Lab

Applied Science

- Physics Lab
- Chemistry Lab
- Language Lab (PC)



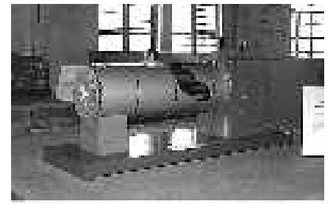
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B.TECH (4 years degree course)

Computer Science & Engineering
Electronics & Communication Engineering
Electrical & Electronics Engineering
Information Technology





The Program

Engineering, much like science, is broad discipline which is often broken down into several sub-disciplines. This disciplines concern themselves with differing areas of engineering work. Although initially an engineer will be trained in a specific discipline, throughout his/her career the engineer may become multi-disciplined.

Electronics Labs

- Electronics Lab
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- Microwave & Optical Communication Lab
- Power electronics & Control Lab
- Network Lab
- Analog IC. Lab
- Digital IC. Lab
- PCB Lab
- DSP Lab
- Electrical Lab

Electrical Labs

- Power Electrical Lab
- Antenna & Wave Propagation Lab
- Electro Mechanical Energy Conversion Lab
- Control System Lab
- Objective Oriented System and C^{++} Lab

CS / IT Lab

- Computer Organization Lab
- Numerical Technique Lab
- Information System Lab
- Computer Graphics Lab

Applied Science

- Physics Lab
- Chemistry Lab
- Language Lab (PC)



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MPT - Master of Physiotherapy
BPT - Bachelor of Physiotherapy
B.Sc. (H) - Microbiology
B.Sc. (H) - Biotechnology
M.Sc. - Microbiology
M.Sc. - Biotechnology





BBA
Bachelor in Business Administration

BCA
Bachelor in Computer Application



5 Yrs. -Integrated Programs

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Biotechnology
Electronics & Communication

MBA
B.Tech in CS & IT +
MBA in Technology Management